JOURNAL

OF THE

AMERICAN CHEMICAL SOCIETY.

VOL. I. No. 5.

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1879.

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THE AMERICAN CHEMICAL SOCIETY.

XIV.—Proceedings.

Regular Meeting, May 1, 1879.

The meeting was called to order at 8 P. M., Vice-President Leeds in the chair. The minutes of the last meeting were read and adopted.

The Board of Directors reported, that at a meeting held April 15, 1879, at 99 Maiden lane—*Present*, Messrs. Squibb, Casamajor, Nichols, Endemann, Goldmark, Waller and Goldschmidt, the following bills were audited and ordered to be paid: P. J. Casamajor, $18.00; S. A. Goldschmidt, $28.85; J. F. Fay, $15.55; G. A. Stechert, $57.50; G. A. Kundahl, $13.15.

The Committee on Papers and Publications reported that Dr. Endemann had been elected working Editor, and submitted for approval, The Journal, Nos. 1–3. It was understood as the sense of the meeting, that all journals and books received as exchanges, should belong to the library of the Society.

It was Resolved, That all moneys received for advertisements in The Journal be used solely as a publication fund.

Resolved also, That the price list of advertisements, selection of abstracts, and form of abstract, be left to the Publication Committee.

At a meeting held May 1—*Present*, Messrs. Leeds, Casamajor, Endemann, Goldmark, Nichols, Waller and Goldschmidt,

It was Resolved, That the Committee on Papers and Publications be directed to order 700 copies of Vol. I, No. 4, from the Editors of the American Chemist, and that if these copies are not delivered upon a day during the month of May, to be set by this Committee, that the Committee be empowered to have this Number printed elsewhere.

Resolved, That the Chair appoint an Auditing Committee, who shall approve of all bills prior to their payment by the Treasurer.

Resolved, That the Secretary be directed to notify the Auditing Committee of all resolutions authorizing the expenditures of money.

The Chair appointed Drs. Squibb and Goldmark as such Auditing Committee.

Resolved, That the Librarian be authorized to purchase three book-cases for the rooms, at a cost not to exceed $70.00.

The Treasurer was directed to pay Lehmaier & Bro., for printing, $171.89, and reported $1,074.28 in the treasury.

Messrs. A. H. Gallatin, M. C. Ihlseng and J. H. Tucker were elected members; and Dr. C. E. Hackly, an associate. Messrs. J. Stillwell, Schanck, M. C. Wilson and Jas. H. Stebbins, Jr., were proposed as members.

A letter was received from Prof. Morton, inviting the Society to hold its May Conversazione at the Stevens' Institute, which, on motion, was accepted.

Mr. Casamajor read the accompanying report on the Berzelius Medal, presented by Dr. Hanbury Smith.

The resignations of Messrs. H. Voorhees and M. W. Iles were read and accepted.

The Committee on Delinquents reported that the following gentlemen had not paid their initiation fees or dues, and recommended that they be dropped from the rolls of the Society, and be requested to return all copies of the PROCEEDINGS which they may have received:

ALLYN, J. G.
BEDFORD, P. W.
BROWN, JOHN J.
BAYLIS, JAMES C.
BORDEN, SPENCER.
CAMPBELL, DOUGLASS.
CECH, DR. C. O.
CHARLTON, T. J.
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CARSON, J. P.
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HART, EDWARD.
KEDZIE, ROB'T G.
KEDZIE, WM. K.
KIMBALL, J. P.
LATTIMORE, S. A.
LOUGHLIN, J. ENEU.
LOWE, C. B. F.
MANSFIELD, J. M.
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McMURTRIE, WM.
MITCHELL, HOWARD W.
MERTZ, HENRY NEY.
McCREE, WM.
MUNZIGER, P.
MUZARD, LEAR.
MOTT, VALENTINE.
NEALE, ARTHUR T.

HAMILTON, HUGH.
HILGARD, EUGENE W.
HINRICHS, GUSTAVUS.
HINSDALE, R. G.
HAGUE, J. D.
JAMESON, HENRY.
JONES, T. W.
KAMMERER, FRED.
KING, CHAS.
NEWTON, ISAAC.
ROEPER, C. M.
SPANGENBERG, F.
STILLMAN, O. B.
STANTON, WILLARD S.
THALBERG, JOHN.
WALLACE, SHIPPEN.
WUTH, OTTO.

Twenty-three members in arrears for the year 1878, shall be suspended from membership until they shall have paid such arrears.

The paper of the evening, "Analysis of Bindheimite," by Chas. E. Wait, was read by Dr. Endemann.

Prof. Leeds made a few remarks upon the history of the discussion relating to Hunt's and Schoenbein's hypothesis, as to the generation of ammonium nitrite by evaporation of water in contact with atmospheric nitrogen, and upon the byproducts obtained in the ozonisation of air by phosphorous.

After which the Society adjourned.

S. A. GOLDSCHMIDT,
Recording Secretary.

ADDITIONS TO THE LIBRARY OF THE AMERICAN CHEMICAL SOCIETY.

From March 1 to May 1, 1879.

PRESENTED BY AUTHOR.

Presented by Leonard F. Beckwith:

"Hydraulic Lime of Teil."

"Béton-Coignet."

Presented by Dr. E. R. Squibb:

"Proposed Legislation on the Adulteration of Food and Medicines."

Presented by Dr. Magnus C. Ihlseng:

"On the Modulus of Elasticity in some American Woods. Determined by Vibration." Sheet. 2 Copies.

"On a Mode of Measuring the Velocity of Sound in Woods." Pamphlet. 2 Copies.

ACQUIRED BY GIFT.

Presented by Prof. S. W. Johnson:

"Annual Report of the Connecticut Agricultural Experiment Station, 1878."

Presented by Prof. C. F. Chandler:

"Reports of New York Board of Health." 1867, '68, '71, '72, '73, '74, '75.

Presented by John L. Hayes:

"Awards and Claims of Exhibitors (Fibres, Fabrics and Textile Machinery), at the International Exhibition, 1876."

Presented by Prof. John M. Maisch:

"Annual Report of the College of Pharmacy. Philadelphia. 1878."

Presented by L. F. Beckwith:

"Arthur Beckwith; Asphaltum and Bitumen."
" " Macademized Streets."
" " Pottery."
"A. De Vathaire; Etudes sur les Haut Fourneaux."

Presented by Dr. S. A. Goldschmidt:

"George Little; Reports on the Progress of the Mineralogical, Geological and Physical Survey of the State of Georgia." 2 Pamphlets.

ACQUIRED BY EXCHANGE.

From the Publishers:

"American Manufacturer and Iron World." 3 Vols.; 1876-7-8.

From the American Institute of Mining Engineers:

Transactions. 6 Vols; 1 to 6.

From the National Association of Wool Manufacturers:

Bulletin. 3 Vols.; 5, 6, 7.
2 Copies of No. 3, Vol. viii.

From the English Chemical Society:

Journal of the Chemical Society, 1878.

From the Pharmaceutical Society of Great Britain:

The Pharmaceutical Journal and Transactions, July to Dec., 1878.

From the Publishers:

"The Journal of Applied Science." 2 Vols.; 8 and 9.

From the Société Industrielle d'Amiens:

Bulletin. 3 Vols.; 1876–7–8.

From the Publishers:

"The Polytechnic Review." 4 Vols.; 1 to 4.

APPARATUS.

Presented by Dr. Pierre De P. Ricketts:

Blackboard.

NEW EXCHANGES.

GERMAN.

Chemiker-Zeitung.
Der Bierbrauer.
Pharmaceutische Zeitschrift für Russland (St. Petersburg).

SPANISH.

Las Clases Productoras.

RECEIVED BY SUBSCRIPTION.

Fresenius. Zeitschrift für Analytische Chemie.

ADDITIONS TO THE LIBRARY.

For May, 1879.

PRESENTED BY AUTHOR.

Dr. Chas. U. Shepard:

"Foreign Phosphates." Pamphlet.

ACQUIRED BY EXCHANGE.

From Wm. H. Wahl:

"Polytechnic Review." Vols. v and vi.

From Mr. C. F. Wingate:

"Plumber and Sanitary Engineer." Vol. i, except Nos. 1 and 2.

New Exchanges.

Proceedings de la Société Industrielle de Rouen.

Furniture.

Presented by Wm. M. Habirshaw:

Mineralogical Cabinet.

Purchased by the Society:

Book-case.

New Exchanges Received

During the Months of March and April.

AMERICAN.

The Plumber and Sanitary Engineer.

ENGLISH.

The Pharmaceutical Journal and Transactions.

Journal of the Chemical Society.

FRENCH.

Proceedings de la Société d'Encouragement pour l'Industrie Nationale.

Bulletin de la Société Industrielle de Mulhouse.

Bulletin de la Société Industrielle d'Amiens.

Report on the Berzelius Medal, Presented to the American Chemical Society by Dr. Hanbury Smith.

On the 17th of last April, the American Chemical Society celebrated its third anniversary by a dinner, which took place at Sieghörtner's Restaurant. At the head of the table was Prof. T. Sterry Hunt, the President of the Society, having on his right Prof. Silliman, of Yale, and on his left Prof. Leeds, of the Stevens' Institute.

In his address to the assembled chemists, Dr. Hunt reminded them that in this year, 1879, occurs, on the 20th of August, the one hundredth anniversary of the birth of Berzelius. He referred to the great Swedish chemist and to the eminent services he had rendered to science.

During the evening a messenger came from Dr. Hanbury Smith, with a very neat morocco case containing a beautiful bronze medal of Berzelius, and the following letter addressed to me :

THE ROCKINGHAM,
Broadway and 56th St.

MY DEAR SIR :

I am very much disappointed to be kept away, by a fit of lumbago, from a gathering I had set my heart on enjoying.

I send hereby a medal I desire to present to the Society, and beg you to be my representative in doing so. It was struck by the Swedish Medical Society to the memory of Berzelius, who then had been the last survivor of the founders of that Society. The likeness is admirable.

Dr. Hunt will, no doubt, allude to the characteristics of Berzelius, his passion for *order*, and his early prophetic conviction that the chemical world was governed by laws of measure, weight and number. Again, his remark : "I feel an ardent longing to strengthen the union between my soul and the unchangeable laws of nature, and for this object will I labor till death stops further progress on this earth." And this object he never lost sight of. Next, his *independence of character*, which, perhaps, sometimes caused him to hold fast to convictions no longer impregnable. His *gentleness* and *bonhommie*. Hence, the great pain which the treatment of Davy, on two occasions, caused him, and the little unpleasantness with Liebig about lactic acid. His content with a very moderate income must not be forgotten, joined to the fact that many pupils who worked in his laboratory, not only paid him nothing, but had free use of his laboratory, &c. He lived for others—he asked nothing for himself—and the world is much better for his having lived in it.

Yours, in respect for his memory,
(Signed) HANBURY SMITH.

This letter possesses remarkable interest from the fact that Dr. Hanbury Smith, who studied chemistry and medicine in Sweden, and lived in that country for many years, was personally acquainted with Berzelius, whom he saw almost daily for several years.

The medal presented to the American Chemical Society is a beautiful work of art. Its diameter is $2\frac{1}{4}$ inches. The face of Berzelius is finely moulded in bold relief, and is full of expression. On the reverse side are represented Medicine, as a sitting female figure, and Chemistry, as a young man who pours a liquid from a flask into a cup held by the female figure. The workmanship is in the best style of numismatic art.

On account of the beauty of this medal, and of the interest which attaches to it in this, the centennial year of the birth of Berzelius, I would suggest that copies of it be taken for the benefit of such members of this Society as desire to subscribe for these copies. In this connection, I am happy to state that I have been so fortunate as to

have secured the promise of the valuable services of Mr. Haas, Sr., Fourth Avenue, corner of 21st St. I believe it is conceded that Mr. Haas is unexcelled in copying works of art by electro-deposition of copper. He has agreed to take copies of the Berzelius Medal, as well as it can be done by the battery, for the following prices, provided he receives an order for at least two dozens of copies :

Copy in two separate halves, each half representing one side of the medal—ready to be mounted on a card—each copy..... $1.50

The two halves mounted on dark green or maroon velveteen—ready for framing..... $2.00

Copy of the medal solid, *i.e.*, both sides soldered together and filled—an exact reproduction of the original—each..... $3.00

It may be necessary to explain that it is not possible by electro-deposition, to obtain the beautiful shining surface which can only be given by a steel die. These copies are, however, to be made in the best style, and equal to any copies by electro-deposition that amateurs have in their collections.

If the members of this Society desire it, I propose to receive subscriptions for these copies, and when these subscriptions call for at least two dozens of copies, I will proceed to collect the sums subscribed and give the order to Mr. Haas.

P. CASAMAJOR,

Corresponding Secretary.

11 E. 14th St.

New York, May 1st, 1879.

XV.—Analysis of Bindheimite, from Arkansas.

By CHAS. E. WAIT.

The antimonial deposits of Arkansas have furnished some interesting minerals ; the analyses of a few of them have been presented to the public.

Several months ago the former owner of one of these mines, gave to me for examination a few ounces of a lemon-yellow, earthy mineral, which came from the Stewart Lode, Sevier County. It gave, upon analysis, the following :

H_2O	5.00	per cent.
PbO	45.38	"
Sb_2O_5	41.72	"
Fe_2O_3	2.06	"
Al_2O_3	4.05	"
SiO_2	1.84	"
Ag	.041	"
	100.091	

Or, neglecting those substances, which we may assume to be impurity, we will have :

H_2O	5.43
PbO	49.26
Sb_2O_5	45.40
	100.09

Representing the composition of the mineral and corresponding to the formula :

$$(PbO)_3.(Sb_2O_5)_2 + 4H_2O.$$

Upon inspection it will be seen that the results of this analysis agree nearly with Analysis No. 2, Dana, page 591. Yet I find they differ greatly from an analysis of Bindheimite, obtained from the same mine, read before the Amer. Assoc. for the Advancement of Science, Nashville Meeting, Aug., 1879.

The author of that interesting paper thinks there exists no fixed ratio between the oxides, but that the number of molecules of water is either once or twice the sum of the molecules of the oxides. Such a ratio may be derived in this case, if we assume part of the PbO to exist as anhydrous, thus giving the formula :

$$(PbO)_2.(Sb_2O_5)_2 + 4H_2O + PbO.$$

This mineral resisted the action of strong nitric and hydrochloric acids, also fusion with the carbonated alkalies, but was readily decomposed by boiling with sulphuric acid.

We may assume, I think, without error, that the mineral under discussion, is the result of the decomposition of Jamesonite, as some interesting specimens of the latter have been found in this mine.

Mo. School of Mines, Rolla, Mo., April 1st, 1879.

XVI.—Upon the Detection and Estimation of Nitrous Acids in Potable Waters, Acids, etc. — I. With Metadiamidobenzol; II. With Potassium Iodide.

By ALBERT R. LEEDS.

I.—WITH METADIAMIDOBENZOL.

This method depends upon the observation, originally made by P. Griess,* that diamidobenzoic acid is an extremely delicate test for nitrous acid, giving in very dilute solutions of this body, an intense yellow color. Later, Griess proposed to employ, instead of this compound, another related compound, *metadiamidobenzol*, which is more readily prepared, and moreover, is twice as sensitive as diamidobenzoic acid. The latter indicates the presence of $\frac{1}{5}$th mgrm. N_2O_3 in a liter of water; the former, of $\frac{1}{10}$th mgrm., or 1 part in 10 million.† Since metadiamidobenzol is said to be an article of commerce at present, there is no need, perhaps, to allude to its preparation. But for those who, like ourselves, were unable to purchase it, it may be of service to know that we were able to prepare it more readily by reduction of the dinitrobenzol by means of tin and hydrochloric acid, than by distillation with acetic acid and iron filings.‡ In accordance with the recommendation of Griess, after purifying with animal charcoal, the solution used in testing was acidified with sulphuric acid.

The minutiæ essential to employment of the method in quantitative colorimetric determinations, have been elaborated by C. Preusse and F. Tiemann,§ who recommend:

I.—A solution of metadiamidobenzol, containing 5 grms. per liter. It is acidified with dilute sulphuric acid.

II.—Dilute sulphuric acid solution (1:3), for acidifying standard and unknown solutions in process of estimations.

III.—A solution of alkaline nitrite, of which 1 cc contains 0.01 mgrm. N_2O_3. 0.0406 grm. pure, dry silver nitrite is dissolved in hot water and decomposed by potassium or sodium chloride. After cooling, the solution is made up to one liter, the silver chloride

* Ann. Chem. u. Pharm., cliv, 333.

† Ber. der deutsch. chem. Gesell., xi, p. 625.

‡ Aromatic Diamines: Hoffmann, Proc. Royal Soc., xi, 518. Isomeric Diamines: Hoffman, Proc. R. Soc., xii, 639.

§ Ber. der deutsch. chem. Gesell., xi, p. 627.

allowed to settle completely, and 100 cc of the supernatant liquid diluted to 1 liter.

The rest of the operations are quite similar in character to those made use of in Nesslerizing. But instead of using cylinders of colorless glass, as the above-mentioned authors recommend, comparison-tubes and the color-comparator,* may be more conveniently employed. 100 cc of the aqueous solution under examination, is introduced into a comparison-tube, 1 cc of solution (2) and 1 cc of solution (1) added. If the water is not colorless, it should first be decolorized by throwing down the coloring matters through formation of an insoluble carbonate of an alkaline earth, in the water containing them. If, on agitation with a bulb-stirrer, a caramel-like color is developed, the trial is to be repeated with 50, 20, 10 cc of the solution, previously diluted to 100 cc with water (free from nitrous acid). The dilution is sufficient, when a satisfactory reaction is attained in the course of one or two minutes. Various amounts of solution (3) are treated in like manner, until an identical tint is developed, when the amount of N_2O_3 in the unknown solution becomes, of course, known.

Inasmuch as the tints of color developed by the metadiamidobenzol, are so analogous to those exhibited by a dilute caramel solution, that they can be closely copied by the latter, the author uses such *a caramel solution in the glass wedge of the color-comparator for estimations of nitrous acid.* The same wedge, provided with a different scale, answers for the determination of minute amounts of ammonia by the Nessler reagent.

Amounts of Nitrous Acid found in Potable Water.

At the time at which these determinations were made, the water of the Passaic, as drawn from the hydrant in the laboratory, contained 0.12 part N_2O_3 in one million. It is of practical importance to compare this result with the amount of nitric acid contained in the same water. A determination of the sum of nitrates and nitrites (calculated as HNO_3), gave on the same date, May 2d, 1879, 2.37 pts. in a million. If we regard this amount of nitric acid as an index of previous sewage contamination, its amount is strikingly great as compared with the nitrogenous matters present in the water and still capable of undergoing putrefactive decomposition. The amount of "nitrates and nitrites" contained in the Passaic, May 2d, '79 (determined by reduction with pig-iron), did not differ notably from

* Proc. Amer. Chem. Soc., Vol. ii, p. 1.

the amount found Nov. 26th, 1877 (by reduction with the copper-zinc couple), when it was 2.22 parts in a million. The ammonia contained in the Passaic water at latter date, was 0.02 parts; the albuminoid ammonia, 0.215 parts in a million. P. Griess has emphatically insisted upon the importance of determining the nitrous acid in potable waters, and their unfitness for household use, when they contain nitrous acid.* In cases like the one cited, where the "nitrates and nitrites," so called, exceed the amount of the albuminoid ammonia *ten times*, there should be no omission to make a separate examination for, and a seperate estimation of, the nitrous acid. The rapidity and ease of Nesslerizing is such, that ammonia and albuminoid ammonia determinations now play the most conspicuous part in reports of water-analyses, especially in this country. To accept or condemn from them alone the character of a drinking-water, we regard as a practice fraught with error. They should be checked by the results afforded by independent determinations of the nitric and nitrous acids. Fortunately, by aid of improved methods, this can be as readily done as the corresponding estimations of ammonia and albuminoid ammonia, and a skillful water-analyst should be able to perform all four within the space of two hours.

We should be very unwilling to say that, by reason of the water of the Passaic containing 0.02 parts of ammonia and 0.215 parts of albuminoid ammonia in a million, it was unfit to drink. But these facts, taken in connection with these two others, that it contains at the same time, 2.14 parts of nitric acid and 0.12 parts of nitrous acid in a million, do, we think, constitute reliable grounds for pronouncing against it. And we regard the two facts last mentioned, of more weight in making up this opinion than the two first. Water flowing from a granitic water-shed and over alluvial country, as the Passaic River does, could not readily obtain this percentage of nitrates from inorganic sources—it has most probably come from the oxidation of nitrogenous animal and vegetable matters. And this opinion is confirmed by finding an amount of nitrous acid, which is *one-half the total amount of the ammonia-yielding bodies present*, and represents how large a portion of these last are still in a state of transition from their evanescent putrescible form, as albuminoid ammonia, to their permanent stage, as nitric acid.

The water of the Passaic has been taken as an illustration, because it happens to be the only potable water which, at the present time, I have occasion to analyze. But having alluded to it, I trust

* Ann. Chem. u. Pharm., cliv, 336.

the importance of the subject will excuse my saying here, that the enforced use of water unquestionably so contaminated as this, is a crime committed against the health and happiness of a quarter of million of people.

II.—WITH POTASSIUM IODIDE.

The well-known method of Trommsdorf is of a colorimetric character.* The potable water to be examined is treated with a solution of zinc iodide, starch and sulphuric acid, which develop, in case nitrous acid is present, a blue color. The amount of nitrous acid corresponding to this color, is found by striking in distilled water containing these reagents, the same tint with a standard nitrous acid solution. Ordinarily, the unknown and known solutions are prepared at the same time and placed side by side, in order that they may be subjected, as nearly as may be, to the same conditions. It is essential, in fact, that they should be equally exposed to the action of the air, and should be acted upon by light of equal intensity and for an equal length of time. To point out the importance and necessity of these precautions, is the object of the present paper. Our attention was drawn to them in the course of preceding studies, upon the rate of change of soluble iodides, in the presence of free acids, and the results of those studies have been given at length (JOUR. AMER. CHEM. SOC., Vol. I, 1879).

Briefly to recapitulate, these results are as follows: *In the dark*, access of air being freely permitted, the amounts of iodine set free, the amount of free acid present being the same in every case, increases with the increase in percentage of dissolved iodide. *In the light*, the iodide liberated, in the case of solutions of equal strength, increases with the amount of exposure to the light and the intensity of the illumination. When air is entirely excluded, no decomposition occurs even at temperatures above the boiling point, and when exposed for days to the direct light of the sun.

These conditions of change having been established, it became of interest to determine in what way the mimetric method of Trommsdorf could be replaced by an absolute mode of volumetric estimation.

As a preliminary determination, the limits of sensitiveness of the zinc-iodide-starch solution were investigated, and the rapidity with which it would undergo change in presence of acid in diffused day-light. Nine comparison-tubes were placed in the comparator-frame, and in each was introduced 100 cc water, 1 cc H_2SO_4 (free

* Zeitsch. für Analyt. Chemie, viii, 358.

from nitrous acid) and 3 cc zinc-iodide-starch solution. This last solution was prepared by adding to 20 grms. $ZnCl_2$ and 5 grms. starch, 2 grms. ZnI_2 and 1000 cc water. The reagents were prepared in the laboratory and were perfectly pure. To the nine tubes were added 0.2, 0.4, 0.8, 1.00, 1.50, 2.00, 2.50, 3.00 and 5.00 cc of a standard solution of potassium nitrite, containing per 1 cc, 0.01 mgrm. N_2O_3. In other words—the first tube contained 2 parts ; the ninth, 50 parts of N_2O_3 in 100 million. This last changed immediately, the others as follows :

With			3 cc N_2O_3 solution, after			10	minutes.	
"		2.5	"	"	"	15	"	
"		2.0	"	"	"	18	"	
"		1.5	"	"	"	50	"	
"	1.0 and	0.8	"	"	"	1	hour.	
"	0.4 "	0.2	"	"	"	1	"	50 minutes.

A tenth tube, containing 100 cc H_2O, 1 cc H_2SO_4 and 3 cc ZnI_2 and *no nitrite*, at the end of two hours had acquired a faint blue color ; in depth, however, inferior to that given by the .002 mgrm. N_2O_3 in the first tube. It will be seen from this table that the reaction cannot be applied to waters containing as much as 0.05 mgrm. N_2O_3 in 100 cc. Perhaps 0.04 mgrm. N_2O_3 in 100 cc is the superior limit, waters containing larger amounts than this, requiring suitable dilution. And, moreover, since the very dilute solutions did not change at the expiration of intervals increasing progressively with the order of dilution, the determinations in these cases are affected with a corresponding degree of uncertainty. This is still more strikingly the case when ordinary potable waters, which are seldom colorless and contain various substances in solution, are used. For example, we have known the water of the Passaic River, which contained, according to a determination on one sample, by means of metadiamidobenzol, 1.2 pts. N_2O_3 in 10 milllion, to remain unchanged, on the addition of zinc-iodide-starch and sulphuric acid, at the expiration of eight hours. After the same interval, distilled water, containing the same reagents, but no nitrite, had acquired a well-defined blue tint.

Apparatus for Absolute Volumetric Determination.

The preceding considerations, having demonstrated the importance of comparing the results obtained by the colorimetric method, with those which would be gotten by some mode of absolute volumetric determination, an apparatus for effecting the latter object was

constructed, as follows: Two comparison-tubes were fitted up in a manner similar to wash-bottles, except that the first comparison-tube was made to slip up and down upon its exit-tube. In this way, its exit-tube might be forced down into the bottom of the vessel when desired. The reagents were placed in the first comparison-tube; 100 cc of the liquid to be tested, in the second. After a current of carbonic acid, washed by passage through a potassium iodide solution, had passed through both vessels for an hour, the exit-tube of the first vessel was pushed down, as above described, and the reagents forced over into the liquid under examination. In this way, the air dissolved in the reagents was swept out of them, before they were allowed to come into contact with the unknown solution. A slow current of carbonic acid was maintained for two hours, at the end of which time the liquids were titrated. The reason for allowing so long an interval to elapse before titration, was, that it had been found previously to be necessary, in order to permit so small a quantity of N_2O_3 as 2 parts in 100 million, to decompose their entire equivalent of potassium iodide. So effectually does the exclusion of air prevent the liberation of iodide under the influence of light alone, that no disturbing influence is exerted upon the results, even when the comparison-tubes are exposed to the direct rays of the sun for two hours or longer.

Example: 100 cc containing 0.05 mgrm. N_2O_3 were introduced in the second comparison-tube, and 6 cc zinc-iodide-starch and 1 cc H_2SO_4 in the first. After complete displacement of the air dissolved in reagents and solution, the reagents were forced over, and the current of carbonic acid gas continued. On titration with sodium hyposulphite, at the end of two hours, the amount required was 0.032 cc = 0.160 mgrm. I. The theoretical amount was 0.0334 cc=0.167 mgrm. I. = 0.05 mgrm. N_2O_3.

Effect of Coloring Matters.

These experiments give the key to an explanation of the effect of coloring matters and organic impurities upon the rate of change of acid solutions of the soluble iodides. They suggest, likewise, a method of eliminating the perturbations so arising, from titrations in which iodides are employed.

Coloring matters, etc., disturb the identity of conditions, under which the colorimetric titration is made. Such an identity is more especially important in a determination like this, inasmuch as the liquids are undergoing a slow spontaneous alteration by contact with light and air. All coloring matters absorb more or less of the

actinism of solar and other light, and, consequently, the amounts of iodine set free will differ correspondingly in solutions containing them. This absorbing action is especially great in the case of yellow solutions, which, like caramel, cut off the more refrangible rays of the spectrum. If, in addition to being colored, these foreign bodies are decomposable and capable of combining with any of the oxygen of the dissolved air, their disturbing influence is two-fold. In the first place, they alter the rate at which acid solutions of soluble iodides decompose under the action of diffused or direct light, and secondly, they remove a portion of the oxygen which is essential to the progress of this decomposition. The conditions governing the reaction are summed up in the general equation, $4MI + 4HA + O_2 = 4MA + 2H_2O + 2I_2$, where M stands for any monovalent basic radical, and A a monobasic acid radical. (See "Influence of Light upon the Decomposition of Iodides," JOURNAL AMER. CHEM. SOC., Vol. I, Part 3, by the author.)

Illustration: These suppositions were confirmed by the following experiment: Four comparison-tubes were prepared, each containing 1 cc KI sol. (20 p. c.) + 1 cc H_2SO_4 + 100 cc H_2O + 0.05 mgrm. N_2O_3. Enough caramel solution was added to each to communicate a strong color. All four were exposed to sun-light for one hour, but through two of them a current of washed carbonic acid was passed, while the remaining two solutions were in direct contact with air. The results were as follows:

Caramel Solutions.

In Air.

I, Required 0.95 cc $Na_2S_2O_3$ = 1.4 mgrm. N_2O_3.
II, " 0.90 " " = 1.35 " "

In Carbonic Acid.

III, Required 0.05 cc $Na_2S_2O_3$ = 0.099 mgrm. N_2O_3.
IV, " 0.05 " " = 0.099 " "

It will be seen, that even where carbonic acid was employed, the amounts of N_2O_3 which were found, are twice those of the A_2O_3 used. This excess was due to using reagents, out of which the dissolved air had not previously been driven by a current of carbonic acid. When this was done, by means of the apparatus before described, the results agreed with the theoretical. In case of the *solutions exposed to air, the discrepancy is enormous*, being nearly thirty times too great. Similar results were obtained in diffused light, but a greater length of time was required to produce them.

CONCLUSIONS: The following conclusions are to be drawn from the preceding experiments:

I. *When the solutions to be titrated are colorless, and contain no compounds, organic or inorganic, which would affect the percentage of dissolved oxygen,* the determination may be made by the colorimetric method.

II. When the solutions are colored, or contain organic or other bodies capable of absorbing oxygen, the *air must be entirely removed from the liquids in order to obtain good results, and an absolute volumetric determination is essential.*

With regard to the first point, it is to be remembered that, in any case, the colorimetric method less and less approximates to accuracy, as we approach the lower limit of the reaction. This is due to the difficulty of securing equivalent amounts of change in excessively dilute solutions, when these solutions contain iodides in presence of free acid, and are not at the same time absolutely identical in tint and constitution. And, with reference to the second point, inasmuch as the coloring matter cannot always be removed from potable waters, by throwing them down through the formation of an insoluble precipitate, it is of utility to possess a method of determining nitrites in presence of coloring matters, and sometimes of certain classes of organic impurities.

Examination of Hydrochloric Acid for Chlorine, and of Nitric and Sulphuric Acids for Nitrous Acid.

After the preceding statements, it will be easily seen that the ordinary rule given in works on qualitative analysis, for the examination of sulphuric acid (*i. e.*, dilution with 20 pts. water and addition of potassium iodide and starch results), gives erroneous results when employed to detect minute quantities of nitrous acid, and the solution is allowed to stand for some time. But if the trial is made in an atmosphere of carbonic acid, care being used to expel previously all traces of air in reagents and in the dilute acid solution, the test and estimation of percentage may be satisfactorily performed. The same remark applies to the examination of hydrochloric acid for chlorine, by means of a soluble iodide. In the case of nitric acid, however, it is well not to expose the acid when under examination, too long to the action of strong light, owing to the liberation of oxygen from the nitric acid itself under these circumstances. The ease and certainty with which the Griess' reaction for nitrous action is performed, should cause it to replace the former methods in most cases. So delicate is it, that the acids sold as chemically pure, usually give a decided color

when the metadiamidobenzol is added to them, and the general introduction of this reagent into use, will probably raise the standard of so-called purity, at least in this respect.

Upon the Degree of Concentration at which Soluble Iodides will cease to remain unchanged in presence of Free Acid, even when out of Contact with Air.

The method pursued in examining this question, was to employ solutions of iodides and acid of gradually increasing concentration, until a point was attained at which decomposition ensued, even when all traces of air were rigorously excluded. The reagents were placed in the first, the iodides in the second comparison-tube, of the apparatus before described, and when all the air had been expelled from both, by the long-continued passage of carbonic acid, the reagents were forced over into contact with the iodides. In the first experiment, 1 cc KI (10 p. c.) + 5 cc H_2O and 1 cc H_2SO_4 (chemically equivalent to the 1 cc KI) + 5 cc H_2O, were employed. After expulsion of air, the solutions stood 1 hour in diffused light, and $\frac{1}{2}$ hour in sunlight, a slow current of carbonic acid flowing. On disconnecting and adding starch, no coloration took place.

In the second experiment similar solutions were used, but instead of being diluted to the $\frac{1}{100}$th, they were diluted only to the $\frac{1}{20}$th. They were exposed to diffused and direct sunlight for the same intervals. Before addition of starch, no change of color was perceptible, but afterwards, a *brownish-red.* This compound was entirely unlike in appearance to that formed by the union of free iodine with starch, under ordinary circumstances.

III. The reagent contained 5 cc KI (10 p. c.) + $2\frac{1}{2}$ cc H_2O, in other words, they were now diluted only to one-tenth. After exposure for $1\frac{1}{2}$ hours to *direct sunlight*, they were brought into contact, when the same *brownish-red* precipitate was formed.

IV. No water was employed, but in its place $2\frac{1}{2}$ cc starch-water, with the same amounts of sulphuric acid and potassium iodide. They were exposed, after expulsion of air, to diffused light for 1 hour, and then to sunlight for $1\frac{1}{2}$ hours. No change occurred in either comparison-tube until their contents were mixed, when the *brownish-red* precipitate formed immediately. On the addition of sodium-hyposulphite, the color disappeared, showing that it probably contained either iodine or hydriodic acid. On collecting and washing the precipitate on a filter, it turned blue, and presented the ordinary appearance of iodide of starch.

V. A final experiment was made by dissolving 10 grms. KI in 30 cc starch-water. 20 cc of this solution were placed in the first comparison-tube, 10 cc concentrated H_2SO_4 in the second, and both treated with carbonic acid. The tubes were exposed to direct sunlight. In a few minutes the first comparison-tube exhibited a brown coloration, and after several hours a carmine-red precipitate was formed. After being allowed to stand over night, the red precipitate was still present, but another also, of a darker hue, lay above. On allowing the carbonic acid to flow through both precipitates for 6 hours, in the sun-light, they disappeared, and the original *brown coloration only* was visible. During this part of the experiment, the iodide and starch, it will be noted, were not mixed with the acid. Finally, they were driven over, when immediate decomposition ensued, and a large amount of iodide was set free.

Conclusions :—1st. In the absence of air and presence of carbonic acid, decomposition of an acid solution of potassium iodide occurs, when the concentration has attained to some point between one-third and one-tenth the weight of the water employed. 2d. During the course of these experiments, a compound of starch has been formed which, from its deportment with reagents, and more especially from its turning blue on absorption of oxygen, may probably be regarded as a *hydriodide of starch*. An attempt would have been made to study it further, had it not been for the difficulty of satisfactorily isolating a body which changed so readily on exposure to air, into ordinary starch iodide.

XVII.—Upon Ammonium Nitrite, and Upon the By-products Obtained in the ozonisation of Air by Moist Phosphorus.

By ALBERT R. LEEDS.

As long ago as 1848, Dr. T. Sterry Hunt threw out the suggestion, that the nitrogen of the atmosphere is really composed of two equivalents of the element, sustaining towards each other the same relations as the two equivalents in nitrous oxide. He supposed that the group NNO is not a simple oxide, but an anhydrous amide, or nitryl, derived from the ammonium nitrate by the removal of $2H_2O$, and capable, when passed over a mixture of lime and potash at a sufficiently high temperature, of regenerating ammonia and a nitrate.* He insisted upon the parallelism between this case and that of am-

* American Jour. Sci., May, 1848, p. 407.

monium nitrite which undergoes a precisely similar decomposition under the influence of heat, losing $2H_2O$ and evolving NN, nitrogen gas. It would appear that Prof. G. C. Schaeffer had independently arrived at a similar conclusion concerning the dual nature of nitrogen, holding the same view as Dr. Hunt, that it is the nitryl of ammonium nitrite, and capable of forming this body by assuming again the elements of water.*

In 1862, Schönbein published an extensive series of experiments upon the generation of ammonium nitrite from water and atmospheric air under the influence of heat.† Unacquainted, apparently, with speculations by which the formation of ammonium nitrite in this manner had been anticipated on theoretical grounds, he announced his own discovery as in the highest degree remarkable and hitherto entirely unexpected. He states that his own labors in this direction, were animated by the consideration that this salt is so readily decomposed under the influence of heat, into water and nitrogen, that it might, under suitable circumstances, be likewise readily regenerated from the same bodies. These circumstances he found to consist in the contact of water, converted into vapor at various temperatures, with atmospheric air, and attributed the combination principally to the heat employed. No other phenomena, according to Schönbein, were concerned in the generation of ammonium nitrite under these circumstances, and those which regulated its formation when various bodies, like hydrogen, hydrocarbons, fats, wood, coal, etc., were burned in air.

It is not necessary to enter into the details of his experiments, further than to remark, that in none of them, apparently, was the precaution taken, to use air which had been purified from its pre-existent ammoniacal and nitrous compounds. This manifest source of error was at once pointed out by Bohlig,‡ who never succeeded, in whatever way or at whatever temperatures, the experiment was conducted, in obtaining the reactions of ammonium nitrite when purified air was employed, but readily obtained them when, under like conditions, common air was used. In opposition to these results of Bohlig, Prof. Liebig maintained in the same journal, the trustworthiness of Schönbein's observations, contending that the fact was sufficiently proven by the very numerous and varied experiments of Schönbein, and disregarding the valid objection, that in none of

* Chemical and Geological Essays, T. S. Hunt, 2d Ed., p. 472.

† Ann. der Chem. u. Pharm., 1862, Vol. cxxiv, p. 1.

‡ Ann. d. Chem. u. Pharm., 1863, Vol. cxxv, p. 21.

these same experiments had purified air been employed. Even to the present day, the generation of ammonium nitrite from atmospheric air and water by the aid of heat, is taught in text-books as an admitted fact, and that, too, after Zabelin, in 1864,* and Carius,† ten years later, had repeated, with exceeding care, and verified Bohlig's observations. In particular, Carius employed most elaborate precautions, using only air and water which had been most carefully purified. The water was evaporated both with a rapid and a slow change of atmosphere; at various temperatures, from the common to 100°; both alone and after addition of baryta, the baryta being devoid of nitrogen compounds; in contact with platinum spirals, and diffused over a great surface of purified cotton wool—in no case was ammonium nitrite formed ‡

* Ann. d. Chem. u. Pharm., cxxx, p. 82.

† Ann. d. Chem. u. Pharm., clxxiv, p. 1.

‡ NOTE.—Since the above was written, a paper has been published by A. v. Loesicke (Arch. Pharm. [3], 14, 54–58, and Chemiker Zeitung, No. 9, 1879). Inasmuch as I have no access to either of these journals, I can only quote from the abstracts (Jour. Chem. Soc., April, 1879, p. 298, Chem. News, Vol. xxxix, p. 150). It is stated in the Journal abstract, that "the author has corroborated Schoenbein's statement, that the evaporation of water in air produces ammonium nitrite, and gives the results of experiments to determine the conditions of its formation. It is found that ammonium nitrite is always formed when water evaporates freely, and the lower the temperature, the larger is the quantity produced; but the formation is prevented if the evaporation takes place in a narnow-necked flask. In another series of experiments, it was observed that one liter of water, evaporated to a small bulk, yielded ammonia equivalent to 0.148 part in 100,000 parts of water; 1 liter, evaporated to small bulk at 40°–50°, yielded ammonia equivalent to 0.5823 part of nitric acid per 100,000 of water; and lastly, 5 liters of water, allowed to evaporate spontaneously, yielded ammonia equivalent to 2.9608 nitric acid per 100,000 parts of water. This last experiment shows the influence that the evaporation of rain-water and dew can have on the nourishment of plants; and it has been found that if a leaf be moistened and allowed to dry, nitrous acid is produced, and that in dew from leaves, ammonium nitrite can be easily detected."

With reference to these observations, it is to be remarked:—1st. In the absence of any reference to the essential precautions of excluding the access of nitrogenized atmospheric particles, atmospheric ammonia and nitrous compounds, it is fair to infer that these precautions were not taken, and in that case, the experiments of Bohlig, Zabelin and Carius, which contradict the hypothesis of Schoenbein, must be regarded as unshaken and conclusive. 2d. The rise of temperature, especially under such circumstances as would establish a current of vapor from the surface of the liquid, would diminish the rate of absorption of nitrogenous bodies from the surrounding atmosphere. Cooling the evaporating liquids would operate in a two-fold manner; in the first place, by augmenting the coefficient of solubility of the atmospheric ammoniacal com-

It is of the highest importance therefore:

I. To exclude the possibility of the conversion of water under the influence of heat in contact with atmospheric air, from among the number of possible sources of ammonium nitrite and nitrous compounds.

II. In cases of rapid oxidation, like the combustion of H,* hydrocarbons,† fats, phosphorus‡ and other bodies in the air, if it be true that ammonium nitrite is formed, irrespective of any nitrogen compounds pre-existent in the atmosphere, the origin of this ammonium nitrite is to be looked for in other causes than the conjunction of atmospheric air and water-vapor under the influence of heat. §

III. The same remark applies if any ammonium nitrite is formed by the slow oxidation of phosphorus in contact with air and water. The very numerous and laborious experiments by which Schönbein appears to have established the fact of the formation of ammonium nitrite under these circumstances, have caused its universal acceptance. ‖ Bohlig following Schönbein, attributed the production of

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pounds; and, secondly, by greatly increasing the length of time required for the spontaneous evaporation of so large a bulk as 5 liters of water.

To get rid of all traces of ammonia upon the surfaces of vessels, is a problem of almost insuperable difficulty so long as laboratory operations must be performed in common air. In this connection we would call to mind the experiments of Faraday,* who was greatly perplexed by obtaining ammonia, on heating hydrogen gas in contact with potassium and zinc. The vessels and substances had been purified, and every precaution exercised, which the almost matchless skill of that incomparable experimental philosopher could devise, and yet Faraday abandoned the research, confessing his inability to satisfactorily account for the appearance of ammonia under these circumstances. Additions to our knowledge since that time, may render it not presumptuous to suggest the cause above given.

* Saussure (Annales de Chemie, lxxi, 282).

† Boettger (Jahresb. d. Phys. Vereins, zu Frankfurt a.M., 1860, 1861, p. 69).

‡ Schoenbein (Ann. der Chem. u. Pharm., Vol. cxxiv, p. 6).

§ In the case of hydrogen, Zoeller and Grete have shown, by the burning of very large volumes of perfectly pure hydrogen in completely purified air, that small amounts of ammonium nitrite are produced, and have demonstrated the presence of ammonia and nitrous acids in the water formed in the course of the combustion, by many concordant and quite satisfactory tests.—(Ber. der deutsch. chem. Gesell., 1877, Vol. x, p. 2,144.)

‖ See Carius, Ann. der Chem. u. Pharm., 1874, Vol. clxxiv, p. 43.

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* Quart. Jour. Sci., xix, 16.

ammonium nitrite during the slow oxidation of moist phosphorus, to the action of the ozone formed at the same time. Carius by elaborate proofs, has demonstrated that ozone, which was prepared by electrolysis in such a manner as to be entirely free from nitrogen compounds, and even from hydrogen gas, was entirely devoid of action upon nitrogen in the presence of vapor of water. In order to make the experiments comparable to those in which ozone is liberated at the same time with a disengagement of heat, as in the case of the electrical discharge, the ozone was brought by Carius into contact with nitrogen and water vapor at all temperatures short of those at which ozone undergoes dissociation into ordinary oxygen—in every case with negative results. The ozone prepared by electrolysis was preferred to that obtained by the electrical discharge, since, as both Soret* and Carius have shown, ordinary oxygen prepared from potassium chlorate, and containing from 1 to 2 p. c. of nitroger, yields, when ozonised by the electrical discharge, small, but determinable amounts of nitrous acid. Still later, Berthelot† has investigated the accuracy of the statement made by Schönbein,‡ that ozone combines with free nitrogen, in presence of alkalies, at ordinary temperatures, to form nitrous compounds.

Schönbein found in 3,000 liters of air, powerfully ozonised by phosphorus, then washed with water, the washings treated with lime water, and the resulting calcium compound decomposed by potassium carbonate, an amount of nitric acid corresponding to 5 grms. of nitre. Berthelot collected in a number of flasks over water, oxygen ozonised by the silent discharge, until the flasks were three-fourths filled. The surplus water was then allowed to run out completely, its place being supplied by atmospheric air, and some pure baryta water introduced in each flask. After standing over night, all traces of ozone had completely disappeared. But the baryta water contained no traces of nitrogen compounds; the wash-water did. Similar results were obtained with the air ozonised by phosphorus, and completely washed before contact with baryta water.

Quite independently of the work done by other observers, an extended series of experiments had been instituted upon the phenomena which accompanied the ozonisation of moist air by means of phosphorus. In the earlier trials, attention was limited to the question whether oxidised compounds of nitrogen were produced or no. Sub-

* Compt. Rend., lvi, 390.

† Compt. Rend., 1877, Vol. lxxxiv, p. 61.

‡ Denkschrift ueber das Ozon, p. 16, Basel, October, 1849.

sequently the research was made to include all other by-products. It was deemed important to purify and measure the air used and the ozone formed; to determine the amount of phosphorus consumed, and of phosphoric and phosphorous acid produced; and, in case they were really present and it were possible to estimate them, the amounts of nitrogen compounds, of hydrogen peroxide and ozone, remaining in solution in the jar- and wash-waters. Lest it be thought needless to have re-investigated these points, the following reasons for so doing may be mentioned:

I. Preliminary trials had shown that, if formed at all, there were grounds for supposing that these products were comparable in minuteness to the nitrogen compounds pre-existent in the atmosphere.

II. Since the time of Schönbein, the experiments of Goppelsröder and Carius had shown that the ozonisation of ammonia would produce ammonium nitrite and nitrate and hydrogen peroxide.

III. We could not discover that in experiments previously made upon the ozonisation of air by phosphorus, the air had been previously purified.

IV. It was important to determine whether any ammonia or nitrous acid existed at the close of the operation, or whether they were completely oxidised to nitric acid. The explanations of the reactions would depend largely upon the determination of these factors.

The phosphorus-ozonator, described in Vol. I, p. 8, of this JOURNAL, was employed throughout the whole course of this investigation. In the first series of experiments, ordinary air drawn from outside the laboratory, was used. The jars in some cases contained common distilled water, in other cases, the bichromate mixture made as described in article alluded to. The ozonised air was aspirated through the kerite-tubing, from the last bell, into a wash-bottle containing aqua puriss. (re-distilled and free from every trace of ammonia), and then into one or more Peligot-tubes containing neutral solution of potassium iodide. Only on titration was the solution of potassium iodide made acid. The reason for this precaution is given (JOUR. AMER. CHEM. SOC., Vol. I, p. 78), where it is shown that a stream of air or oxygen passing through an acidified solution of potassium iodide, greatly increases the amount of iodide set free. The nitric acid in the wash-bottle was determined by reduction with pig-iron, the precautions being employed which are stated (PROCEEDINGS AMER. CHEM. SOC., Vol. II, No. 4, 1878).

TABLE I.—NITRIC ACID FORMED WITH NON-PURIFIED AIR.

Air Used.	Total Ozone in mgrm.	Total Ozone in cc.	V. p. c. of Air.	Total HNO_3.	HNO_3 p. c.
27 liters (over H_2O)	—	—	—	0.111	0.000318
108 " " "	—	—	—	0.444	0.000318
45 " (over CrO_3)	13.61	6.37	0.014	0.314	0.00054
85 " (over H_2O)	77.07	36.09	0.039	0.333	0.000303
90 " (over CrO_3)	71.91	33.67	0.037	0.610	0.00054

In the following trials, the air was purified by aspiration through a tube one-half meter in length, packed with cotton-wool, then through three Peligot-tubes, the first containing aq. puriss., the second soda solution, the third sulphuric acid. The soda employed in this and other trials was some made from sodium, and which had been repeatedly proven to be free from nitrogenous bodies. The sulphuric acid yielded to metadiamidobenzol no trace of nitrous acid, nor any ammonia on neutralization and reduction. Ordinary distilled water was employed in the jars.

TABLE II.—NITRIC ACID FORMED WITH PURIFIED AIR (AQ. PUR.).

Air Used.	Total Ozone.	Total Ozone.	V. p. c. of Air.	Total HNO_3.	HNO_3 p. c.
	MGRM.			MGRM.	
262 liters (over H_2O)	261.8	104.16 cc.	0.04	1.11	0.000328

In an experiment similarly arranged, except that hydrant water was used in the jars, 0.3964 grm. of ozone was produced. The wash-water contained 0.37 mgrm. of nitric acid, and 1.3 mgrm. of hydrogen peroxide. The latter would correspond to 0.00039 per cent. of the total weight of the air used.

In the foregoing experiments, the percentage of nitric acid as compared with the weight of the air passed over, appears quite constant. This is true whether water or bichromate mixture was employed, although with the latter the percentage was somewhat higher. The ozone had been manufactured for a variety of purposes, and these percentages were not calculated until after all the determinations were concluded, when an unexpected closeness of agreement between the results was developed. Although this agreement pointed to a constantly operating cause, yet, by reason of the extreme minuteness of the amounts of nitric acid, it was deemed safer provisionally to assume that the agreement was really due to a constant source of error. A scheme was therefore drawn up, which

should include the sources of error and the substances to be determined to the best of our knowledge. As others may detect features in which our methods were at fault, or essential precautions were overlooked, this scheme is given below :

I. Use of a measured amount of aq. puriss., in the jars.

II. Complete straining and washing of the air by means of cotton-wool, aq. puriss., NaOH and H_2SO_4, both shown to be free from nitrogen.

III. Weight of phosphorus cakes before and after the experiment.

IV. Amount of ammonia in the jar-water at close of experiment.

V. Also of the nitrites and nitrates, as determined by reduction.

VI. Amount of nitrous acid, as determined by metadiamidobenzol.

VII. Amounts of phosphoric and phosphorus acids and of hydrogen peroxide in the jar-water.

VIII. Estimation of H_3N, (HNO_3 and HNO_2), HNO_2, H_3PO_4, H_3PO_3 and H_2O_2, in the wash-water after ozonising ("ozone-wash-water").

IX. Similar estimations, except of the phosphorus compounds, in the solutions employed to wash the air ("air wash-water").

X. Measurement of total volumes of air used, and of ozone after its escape from the ozone wash-water.

In order to compensate for the increase of suction necessitated by so many wash-bottles, the standards and discs carrying the phosphorus were raised nearly to top of the bells.

This required the employment of 11 liters of aq. puriss. in the jars. After 420 liters of air had been aspirated, the jar-water was poured into three tall cylinders, the precipitate, mostly lead phosphate, allowed to settle, and the water and precipitate analyzed separately. The weight of the phosphorus cakes at beginning of the experiment was 111.646 grms., at the close 54.284 grms. The total amount of ozone which passed out of the ozone wash-bottle, was 0.8046 grm., or an average of 1.92 mgrm. ozone per liter of air, the temperature varying during the course of the six days consumed in the experiment, between 18° and 21°. This would correspond to 71.29 grms. of phosphorus consumed, for each gramme of ozone produced. Probably the consumption would be in a somewhat different ratio at the temperature of maximum evolution (24°), and with bichromate mixture in the jars.

PHOSPHORIC AND PHOSPHOROUS ACIDS.

The amount of phosphoric acid (H_3PO_4) existing in solution in the jar-water, was 178.02 grms.; in combination with the lead as triplumbic phosphate, 0.939 grms.; and the comparatively small amount carried over into the ozone wash-water was 0.252 grm., making a total of 179.24 grms.

The large amount of phosphoric acid is itself a valuable product, and capable either of being used directly or of being easily reconverted into phosphorus. Hence, its formation cannot be considered as a drawback upon this method of ozonising. The phosphorous acid in the jar-water was 2.57 grms., in the ozone wash-water, 0.013 grm.

AMMONIA, NITROUS AND NITRIC ACIDS.

(*a.*) *In air wash-water.*—The entire ammonia derived from washing 420 liters of air, was .03 mgrm., corresponding to 6 parts in 100 million. No nitrous acid could be detected by means of metadiamidobenzol; nitric acid not determined.

(*b.*) *In jar-water.*—50 cc of the jar-water rendered alkaline with pure soda, and distilled in a purified retort, yielded 0.08 mgrm. H_3N, corresponding to 17.60 mgrms. ammonia in the 11 liters. A like portion, similarly treated, gave, on reduction with pig-iron, 0.14 mgrm. H_3N, or in the total jar-water, 0.0308 grm. Both NH_4NO_2 and NH_4NO_3 should yield on reduction twice the amount of ammonia which they give when the ammonia is determined directly. In the above determination, the amount which was found falls short of the theoretical by a difference quite within the errors of experiment.

Since phosphorous acid was contained in the jar-water, it became important to determine whether this body, when distilled in neutral or slightly alkaline solution, with pig-iron, would yield a distillate capable of effecting the Nessler reagent. Some phosphorous acid was therefore prepared from phosphorus trichloride, and the experiment tried, but the results obtained negatived the above hypothesis.

No nitrous acid was detected. The nitric acid, as deduced from the ammonia found directly and after reduction, amounted to 0.0489 grm., or 0.0089 per cent. of the total weight of the air used.

(*c.*) *In ozone wash-water.*—The ammonia obtained by direct distillation amounted to 0.075 mgrm.; by reduction, to 0.315 mgrm.; this would leave for the ammonia, corresponding to the nitric acid, 0.24 mgrm. (equivalent to 0.88 mgrm. HNO_3), a result three times

greater than the ammonia corresponding to the base, instead of twice, as should have been.

No nitrous acid was found by the use of metadiamidobenzol.

HYDROGEN PEROXIDE.

The ozone wash-water contained 2.01 mgrm. hydrogen peroxide, or 0.00037 per cent. of the total weight of the air passed over. The nitric acid contained in the ozone wash-water, was only 0.000162, or about one-half the percentage of the hydrogen peroxide.*

Final experiment.—The failure to find in the jar-water an amount of ammonia, on reduction, which would exactly correspond to the nitric acid required to form with the basic ammonia, ammonium nitrate, cast some suspicion on the above results. A final experiment was therefore instituted, in order to settle positively whether any ammonium nitrite could be detected at the close of the operation, and whether all the nitric acid found, existed in combination as ammonium nitrate.

Renewed precautions were therefore instituted to purify the air employed—two columns of glass beads saturated with H_2SO_4, being employed in addition to the wash-bottles mentioned in the former trials. The air was forced by a tromp through this long series of purifiers into the ozonator, and drawn out again through the wash-bottles used to wash and titrate the products, by means of a water air-pump. By this means, the phosphorus cakes were always kept immersed to the same depth in the jar-water. Sliding standards had been discarded in the improved form of ozonator now employed, and the cakes were supported on leaden discs which rested upon little leaden brackets, passing through holes drilled through the sides of the bells, at a small distance above their lower rims. 4,850 cc aq. puriss. were used in the jars; the amount of air passed through the apparatus was 481 liters; the ozone discharged from the ozone wash-water, 0.924 grm. The following table presents a synopsis of the results obtained:

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* NOTE.—In Table I, the ammonia found in the ozone wash-waters by reduction is all calculated as HNO_3. If we, in like manner, convert the total ammonia contained in the air (see Table III) into HNO_3, it will be found equal to 0.000088 per cent. of the air drawn over; subtracting this from 0.0003 per cent., the amount given for P over H_2O in Table I, leaves 0.000212 per cent., and this, if regarded not as it was when the experiments were made, as HNO_3, but as NH_4NO_3, would give for the true percentage of HNO_3 in Table I, 0.000167 p. c.

TABLE III.

Air wash-water.

Ammonia.		HNO_2	HNO_3	NH_4NO_2	NH_4NO_3
Before Reduction.	After.				
MGRM.	MGRM.	MGRM.	MGRM.	MGRM.	MGRM.
0.10	0.15	0.065	0.104	0.092	0.132
Corresponding in 100 million parts.					
PARTS.		PARTS.	PARTS.	PARTS.	PARTS.
16	None.	10	17	15	20
Jar-water.					
MGRM.	MGRM.		MGRM.		MGRM.
(1.) 7.76					
(2.) 4.82	11.64	None.	21.57	None.	27.39
Ozone wash-water.					
0.066	0.198	None.	0.49	None.	0.31

It will be noted that the ammonia washed out of the atmospheric air, is somewhat in excess of that required to neutralize the nitric and nitrous acids, and it may be queried whether this excess existed in some other form of combination, as the carbonate.

The determination marked (1) of ammonia in the jar-water, was made upon 50 cc. Subsequently the same apparatus was employed as that ordinarily used in water analysis, and after the large amount of soda required to render 500 cc of the jar-water alkaline, was repeatedly distilled with aq. puriss. until it gave no further reaction of ammonia, the 500 cc was added, and the distillations continued. This determination corresponded to 5.82 mgrm. H_3N in the total jar-water, and is just one-half the amount obtained after reduction. Since the absence of nitrous acid was proven, this result goes far to demonstrate that the ammonia derived from the jar-water, existed there as ammonium nitrate.

But in the ozone wash-water, instead of being one-half, it is only one-third of the amount found on reduction, a result corresponding with that found in the former trial.

Hydrogen Peroxide.—As determined directly upon one portion of the ozone wash-water, this amounted to 2.7 mgrm.; determined after evaporating 30 cc down to 3 cc, it amounted to 2.4 mgrm. The estimation was made by means of sodium hyposulphite and potassium iodide. These reagents could be safely made use of, since the absence of nitrous acid had been previously proven. It was like-

wise found that the presence of phosphorus acid had no effect upon the titration. If the larger result obtained on titrating directly, be attributed to dissolved ozone, then the amount of ozone in solution would have been 0.44 mgrm. Since, however, the percentage of hydrogen peroxide is diminished by concentration with the aid of heat, the lower result obtained after evaporation, might, perhaps, be more satisfactorily attributed to the loss of hydrogen peroxide than to expulsion of dissolved ozone.

The percentage of hydrogen peroxide, as compared with the total weight of the air drawn over, is 0.00038 ; that of nitric acid in the ozone wash-water only 0.00008. The former agrees quite closely with the result obtained in the previous experiment ; the latter is about one-half.

Conclusion.—It will be noted that the chief by-product of the ozonisation of moist air by phosphorus, according to our determinations, is not phosphorous acid, but phosphoric acid. It is generally stated that the former of these two substances, is the one principally produced under these circumstances. This may be true in the sense that the phosphorous acid is first formed, and that it gradually is transformed into phosphoric acid under the influence of nascent ozone. This point could not be very readily determined, in the course of the experiments made with the apparatus described above.

It is certainly an error to ascribe, as is done in various text-books, the dense, white fumes seen in the ozonising chambers, to ammonium nitrite—they are chiefly due to phosphoric anhydride.

The above experiments do not permit us to say that no ammonium nitrite was found during any period of the ozonation, they prove merely that no ammonium nitrite could be detected at its close. If, therefore, this body were produced, it must have become oxidized to ammonium nitrate.

As to the reason of the formation of ozone itself under these circumstances, it may be conjectured along with Lamont* and others, that it is connected with the uneven quantivalencies of the elements taking part in the reaction, which may be represented by the equation $P_4 + O_{14} = P_2O_3 + P_2O_5 + 2O_3$. If this hypothesis be true, then we should anticipate the development of ozone whenever oxidation of a perissad occurred at temperatures compatible with the stability of the ozone molecule. Even at the temperature of combustion of hydrogen, this is supposed by C. Than† to be the case. He explains

* Chem. News, xxviii, p. 236.

† Jour. Chem. Soc. [2], Vol. ix, 1871, p. 483 ; J. pr. Chem. [2], i, 415.

in this manner the presence of the ozone, which he states he has detected in the combustion of hydrogenous substances generally, and its absence in the combustion of carbon.

In entering into new combinations, the oxygen molecules must undergo temporary resolution into their constituent atoms. These, while en route to take up new positsons in other combinations, and animated by their atomic energy, or energy of the nascent state, may either oxidize the oxygen molecule, or the nitrogen, or the molecule of water. In the first case, ozone would be produced; in the second, regarding water as the basic body and NNO as the nitryl, there might be formed, as Hunt has indicated, ammonium nitrate; in the third, hydrogen peroxide.

It gives me much pleasure to acknowledge the co-operation of my assistant, Dr. Edgar Everhart, in the performance of these experiments.

Abstracts from American and Foreign Journals.

Berichte der deutschen chemischen Gesellschaft.

Abstractor, P. Townsend Austen, Ph. D., F. C. S.

On Betuline, N. Franchimont (Ber. d. d. chem. Ges., vol. xii, p. 7).—By extraction of birch bark with boiling alcohol, distilling off the alcohol, taking up the residue in water, treating with sodium hydrate, and crystallizing the product from benzol or petroleum ether, betuline was obtained in the form of colorless needles, fusing at 251°. The acetate (fusing at 216°) was made according to Hausmann's method. By saponification with alcoholic potash, betuline was regenerated. F., hence, considers that Hausmann's formulæ, $C_{36}H_{60}O_3$ for betuline, and $C_{36}H_{58}O(C_2H_3O_2)_2$ for betuline-acetate, are correct. To produce a hydro-carbon from betuline, by extraction of the elements of water, phosphorous pentasulphide proved to be the best reducing agent. The mixture, on being heated, fused and evolved H_2S and PH_3. The operation was hence conducted in a current of carbonic acid. After twelve hours the liquid was distilled off up to 300°. A thick, brown mass was obtained, which, by fractional distillation, drying over calcium chloride, etc., gave a colorless, liquid hydro-carbon. If pure, it would appear to be $C_{13}H_{20}$. Oxidizing agents, fuming sulphuric acid and nitric acid, acted on this hydrocarbon, but no defined products could be obtained. Hydrochloric acid gas gave no reaction.

On Lactucone, N. FRANCHIMONT (Ber. d. d. chem. Ges., vol. xii, p. 11).—Lactucanium, made from *Lactua altissima*, was extracted with water and dilute alcohol. The residue was boiled out with 90% alcohol. On cooling, watery concretions were obtained, which, by repeated crystallization, gave masses of microscopic needles, fusing at 296°. After fusing it is amorphous. It is insoluble in water, difficultly in alcohol, easily in petroleum ether. Analysis gave $C_{14}H_{24}O$, which does not agree with the formula deduced by Lenoir and Ludwig. Acetic anhydride did not act upon it when heated to 200° in a closed tube.

By heating with phosphorous pentasulphide, and distilling in a current of carbonic acid, after the evolution of hydrogen sulphide had ceased, a liquid hydro-carbon was obtained, which, after being washed with potassa, was distilled in a current of steam, dried over $CuCl_2$ and sodium, and fractioned. The fraction between 247° and 252° proved to be a hydro-carbon arising from the extraction of the elements of water, and corresponding to the formula $C_{14}H_{22}$. Author thinks Lacrucone to be, at least empirically, homologous with camphor and the zeorine of Paterno.

On Zinc Acetate, N. FRANCHIMONT (Ber. d. d. chem. Ges., vol. xii, p. 11).—Contrary to the statements in several text-books, that zinc acetate contains three molecules of water of crystallization, two of which are evolved at 100°, the author finds the salt contains but two molecules, both of which escape at 100°. The salt does not fuse in its water of crystallization; placed in a capillary tube, it fused at 235–237°; free from water, it fused at 241–242°, and sublimes at that temperature. The sublimed salt does not fuse more easily than the dried, but at the same temperature, and is anhydrous zinc-acetate. Under decreased pressure, the salt is entirely volatile, probably without decomposition.

On the coloring matter of Sandal-wood, N. FRANCHIMONT (Ber. d. d. chem. Ges., vol. xii, p. 14).—It was obtained by extracting rasped sandal-wood with boiling alcohol, precipitating with water, and purifying by means of the lead-acetate compound. It is not crystalline, fuses at 104–105°, and has the composition $C_{17}H_{16}O_6$. It is easily soluble in absolute alcohol, ether, and alkaline carbonates, being precipitated from the latter by HCl, but not by CO_2. It is difficultly soluble in ether, and insoluble in chloroform and carbon disulphide. Red sandal-wood, treated in the same manner, yielded the same

compound. Fused with caustic potash, it gave, besides a small amount of a very volatile body, with the odor of rose-wood, acetic acid, resorcine, and probably protocatechnic acid and pyrocatechine. Heated with concentrated HCl in a closed tube, at 150–180°, it gave a strong pressure of chlor-methyl. The amount of chlor-methyl was estimated and found to correspond to one methyl group. The residue from the HCl, treated with alcohol, left a black, glittering substance, from which no analytical results could be obtained. The alcoholic solution contained a substance agreeing with the formula $C_8H_{10}O_5$. The HCl solution, extracted with ether, yielded a small amount of a body crystallizing in colorless needles.

Water was without action on the coloring matter at 180°. Nitric acid gave picric or styphnic acid. Alkaline potassium permanganate gave a strong odor of *vanilla*, but no vanalline could, with certainty, be obtained, while oxalic and acetic acids were formed. Reducing agents had no effect. Hydriodic acid acted similarly to HCl, yielding iod-methyl. Heated in a closed tube at 200° with acetic anhydride, an acet-compound was obtained. The results give no key to the constitution of the coloring matter, but show that it is related to the aromatic series, and particularly to protocatechnic acid.

Influence of the Chemical Composition of Water in the Production of Raw Silk, L. Gabba and O. Textor (Ber. d. d. chem. Ges., vol. xii, p. 17).—Those constituents of silk which are soluble in water, give it its appearance, color and strength. They should, hence, remain in the silk, if the best product is to be obtained. Authors have analyzed many waters used by the silk works producing the most excellent products, and conclude that the silk treated in soft water has a less fine appearance, less beautiful color and is weaker, than that treated in hard water, which is owing to the "varnish," or soluble constituents, being dissolved more easily in the soft than in the hard water. They have confirmed this by numerous experiments, and conclude that the best silk is obtained by the use of water containing lime or alkalies. Such silk, however, is not best for dyeing, since it contains lime, which causes it to take color unevenly.

Action of Mono- and Diphenyl-Arsenic Acid on the Animal Organism, H. Schulz (Ber. d. d. chem. Ges., vol. xii, p. 21).—As dimethyl-arsenic acid (kakodylic) is not poisonous, author thought that the mono- and diphenyl-compounds would also be harmless. Experiment proved that 0.1 grm. of the mono-, and 0.5 grm. of the

diphenyl-compound produced death, when injected hypodermically. S. supposes that the compounds are decomposed with the evolution of arsenic acid:

(1.) $C_6H_5AsO.(OH)_2 + H_2O = C_6H_6 + H_3AsO_4$ or
$2C_6H_5AsO.(OH)_2 = 2C_6H_5OH + As_2O_3 + H_2O.$
(2.) $(C_6H_5)_2.AsO.OH + 2H_2O = (C_6H_6)_2 + H_3AsO_4.$

Action of Dimethyl-Arsenic Acid (Kakodylic) on the Animal Organism, H. SCHULZ (Ber. d. d. chem. Ges., vol. xii, p. 22).—Contrary to the observations of Bunsen and Kürschner, kakodylic acid $[(CH_3)_2.AsO.OH]$ is found to produce death, with all the symptoms of arsenical poisoning, thus verifying the results of Lebahn (1868).

Action of Hydrocyanic Acid upon Epichlorhydrine, J. v. HÖRMANN (Ber. d. d. chem. Ges., vol. xii, p. 23).—From the result of the action of hydrocyanic acid upon epichlorhydrine, in a closed tube for 120–150 hours, at 40–70°, ether extracts a light, mobile, brownish liquid, with a peculiar odor. Analysis gave C_4H_6ClON. The reaction, hence, appears to be $C_3H_5OCl + HCN = C_3H_5ClOCNH$, and the compound consequently must be considered as the nitrite of a chlorhydroxybutyric acid:

$CN—CH_2—CH(OH)—CH_2Cl$ or
$OH—CH_2—CH(CN)—CH_2Cl.$

It is easily soluble in water, alcohol and ether; does not distil, but carbonizes at 200°, with the formation of ammonium chloride. By heating with mineral acids, the corresponding carboxyl acid is formed, which is a thick uncrystallizable syrup, easily soluble in water. It is unstable, and gives no constant analytical results, but changes to an insoluble gum, probably an anhydride. The salts are also not stable, and decompose, forming chlorides of the base.

On Succinyle-compounds of Toluidine, (preliminary notice) G. v. BECHI (Ber. d. d. chem. Ges., vol. xii, p. 25).—By heating 1 mol. of succinic acid with 1 mol. of ortho-toluidine, and purifying the fraction going over at 320° by crystallization from ether, toluylesuccinimide was obtained in the form of glittering needles, fusing at 75°, and distilling without decomposition at 345° (uncorr.), some 60° lower than the corresponding aniline compound. Its constitution is $C_2H_4 <^{CO}_{CO}> N—C_6H_4—CH_3.$

On Acetates of Chlorine and Iodine, B. ARONHEIM (Ber. d. d. chem. Ges., vol. xii, p. 26).—The author finds that Schützenberger's "acetates of chlorine and iodine," $C_2H_3O_3Cl$ and $C_2H_3O_2I$, which were supposed to be formed by the action of gaseous Cl_2O upon acetic anhydride, have no existence.

Action of Nitrous Acid on Resorcine Ether, B. ARONHEIM (Ber. d. d. chem. Ges., vol. xii, p. 30).—*Nitroso-mono-ethyl-resorcine-ether.*—Resorcine-diethyl-ether, in acetic acid solution, on being treated gradually with Stenhouse's solution of nitrous acid, gave, instead of nitroso-diethyl-ether, the mono-ethyl-ether, $C_6H_3(OC_2H_5)NO.OH$. The compound is remarkably stable. It is soluble only in caustic alkaline solutions. It gives the reactions of the nitroso-phenoles. Above 150° it decomposes, without fusion. With aniline and acetic acid, an azo-compound is formed. Reducing agents give an easily soluble base, whose solutions turn blue on exposure to the air. Nitric acid gives rise to a dinitro-compound.

On Digallic Acid, HUGO SCHIFF (Ber. d. d. chem. Ges., vol. xii, p. 33).—Freda found, that, after converting gallic acid into digallic acid, by means of arsenic acid, only gallic acid could be obtained after precipitating the arsenic with H_2S. S. finds that a small amount of arsenic acid will convert a large amount of gallic acid into digallic acid by long continued boiling in alcoholic solution. S. regards the change as one comparable with etherification, and thinks an intermediate compound containing arsenic, may be formed. Artificial digallic (tannic) acid behaves like the natural acid towards alkaloids. The conversion, when performed in an aqueous solution with an excess of arsenic acid, yields much less digallic acid. In the separation of large amounts of arsenic acid by means of hydrogen sulphide, considerable gallic acid is regenerated. Pure anhydrous gallic acid fuses at 240°.

On Some Derivatives of Hydrochinone, R. NIETZKI (Ber. d. d. chem. Ges., vol. xii, p. 38).—*Mono-nitro-diethyl-hydrochinone* is formed by the action of nitric acid on hydrochinone in glacial acetic acid solution. It crystallizes from dilute alcohol in beautiful golden-yellow needles an inch long, fusing at 49°. By heating with alcoholic potash with occasional additions of zinc dust, a mixture of hydrazo and azo compound was obtained. The hydrazo body oxidized so quickly that it could not be procured for analysis. The azo compound fuses at 120°, and forms vivid red leaves resembling

azo-benzol. Concentrated hydrochloric and sulphuric acids dissolve it to a deep violet color. At a high temperature it is to a great extent distillable. Its constitution is:

$$(C_2H_5O)_2 = C_6H_3 - N = N - C_6H_3 = (OC_2H_5)_2.$$

Diamido-diethyl-hydrochinone.—The reduced mass freed from potash by washing, on treatment with HCl, gave the hydrochloride, long fine needles, difficultly soluble in water and precipitated therefrom by HCl, thus affording an easy method of obtaining it pure. The base forms soft, colorless leaves, similar to benzidine, fusing at 129°. Its constitution is:

$$(C_2H_5O)_2 = C_6H_2 \begin{matrix} NH_2 \\ - \\ - \end{matrix} \begin{matrix} - \\ - \\ NH_2 \end{matrix} = (OC_2H_5)_2.$$

Dinitro-diethyl-hydrochinone is isomeric with the body described in a previous paper, and is formed at the same time. It is far more easily soluble in alcohol. It fuses at 130°. By treatment with nitrous acid, the diamine found from this body does not yield a phenole, but a substance crystallizing in colorless needles and containing nitrogen. It fuses at 233°. Analysis gave $C_{10}H_{13}N_3O_3$.

Answer to O. Hesse, CHAS. RICE (Ber. d. d. chem. Ges., vol. xii, p. 44).

Contributions to the Knowledge of Certain Kinds of Sugars. M. HÖNIG and M. ROSENFELD (Preliminary Notice, Ber. d. d. chem. Ges., vol. xii, p. 45).—*Fruit-sugar-sodium*, $C_6H_{11}O_6Na$, is obtained in the form of a white gelatinous precipitate, by treatmeut of an alcoholic solution of fruit-sugar with sodium ethylate. When dried, it is yellowish-white, easily pulverized, deliquescent, and almost insoluble in alcohol. At 100° it loses one molecule of water, and forms a dark brown amorphous mass, smelling strongly of caramel.

Milk-sugar-sodium.—Properties same as preceding substance.

On Paraphenylendiamine, A. KRAUSE (Ber. d. d. chem. Ges., vol. xii, p. 47).—Treatment of paraphenylendiamine with chloride of lime and hydrochloric acid, gave a compound, $C_6H_4Cl_2N_2$. It forms beautiful white needles, decomposing at 120° (bromine gives a similar compound). With reducing agents paraphenylendiamine was regenerated. Treated with strong hydrochloric acid, a body crystallizing in bright red needles, $C_6H_4Cl_4N_2$, and giving chloranile on treatment with nitric acid, was obtained. The chlor-compound, $C_6H_4Cl_2N_2$, also gives chloranile on treatment with nitric acid.

Bichlor-bibrom-chinone, $C_6Cl_2Br_2O_2$, is formed by treating the chlor-compound with bromine.

$$C_6H_4Cl_2N_2 + Br_4 + 2H_2O = C_6Cl_2Br_2O_2 + 2NH_4Br.$$

Bronze colored rhombic leaflets volatilizing at 200°.

Mono-chlor-monobrom-anilic acid, $C_6H_2ClBrO_4$.—The preceding compounds, treated with dilute soda, gave the sodium salt of the anilic acid. The free acid forms, when anhydrous, a minium red powder; when containing water, bright red micaceous leaflets.

The conversion of the chloro-body into $C_6H_4Cl_2N_2$ into bichlorbibromchinone, appears to prove that the chlorine atom has entered the ring, and make the following constitutions probable:

$$C_6H_2Cl_2\begin{cases}NH\\NH\end{cases}; \quad C_6H_2Cl_2\begin{cases}NH_2\\N\end{cases}\!\!=\!\!\begin{cases}N\\NH_2\end{cases}$$

Behavior of Alkaline Alumina Solutions toward Hydrogen Sulphide, GERHARD LÖSEKANN (Ber. d. d. chem. Ges., vol. xii. p. 56).—Alumina in caustic alkali solution is entirely precipitated on treatment with hydrogen sulphide. On boiling the mixture, the precipitate dissolves. Chromium is also precipitated, but does not dissolve on boiling.

On the Decomposition of Bichloracrylic Acid by Alkalies, O. WALLACH and O. BISCHOFF (Ber. d. d. chem. Ges., vol. xii, p. 57).—By treating bichloracrylic acid with barium hydrate, and decomposing the Ba salt formed by HCl, an acid was extracted by shaking with ether. The Ag salt was very explosive. Treated with dilute acid a gas was evolved, which took fire on contact with the air, and when led into bromine, gave tetrabrom chlorethane. It hence arose from monochloracetylene. The acid, therefore, appears to be a chlorpropiolic acid, CCl = C—COOH, and the silver salt, chloracetylensilver, Ccl =C—Ag.

Dibrom acetophenone treated with HCN, gave instead of the hoped for

$$CBr_2H—C(C_6H_5)CH\begin{cases}OH\\CN\end{cases}$$

carbonic oxide, brommethyl, benzaldehyde and benzoglycolic acid.

Some Reactions of Silver Ultramarine, KARL HEUMAN (Ber. d. d. chem. Ges., vol. xii, p. 60).—By action of hydrochloric acid on silver-ultramarine, two-thirds of the silver separates as AgCl, and

one-third as Ag_2S. By long-continued boiling with sodium chloride, two-thirds of the silver separates as AgCl. The remaining third is not extracted.

On the Relative Affinity of Oxygen to Hydrogen and Carbonous Oxide, H. A. HORSTMANN (Ber. d. d. chem. Ges., vol. xii, p. 64).—Not suitable for abstraction.

On Eikosylene, a Derivative of Peat-Paraffine, E. LIPPMANN and J. HAWLICZEK (Ber. d. d. chem. Ges., vol. xii, p. 69).—Most of the commercial paraffines were found to contain oxygen. It was removed by heating with sodium in a closed tube at 250°. The pure paraffine was chlorinated by heating with phosphorous pentachloride. The mixture of chloro-compounds was distilled *in vacuo*, and yielded $C_{20}H_{39}Cl$, arising from the splitting off of HCl from $C_{20}H_{40}Cl_2$. The former body, on distillation under normal pressure, gave a hydrocarbon, $C_{20}H_{38}$, which the authors term eikosylene, having the properties of an olefine, and combining energetically with halogens. Treated with Cl in tetra-chlor-methane solution, a bright yellow, heavy oil, $C_{20}H_{38}Cl_2$, eikosylene chloride, was obtained. The bromine derivative, $C_{20}H_{30}Br_2$, was similar in properties.

The authors, hence, infer the existence in paraffine of a hydrocarbon, having the composition $C_{20}H_{42}$, homologous with cetylene, $C_{16}H_{30}$.

On Amyliden-aniline, E. LIPPMANN and W. STRECKER (Ber. d. d. chem. Ges., vol. xii, p. 79).—Aniline treated with valeraldehyde, according to Schiff's reaction, gave a base, $C_6H_5.N.C_5H_{10}$, crystallizing in oblique prisms of a glassy lustre, fusing at 97°. The hydrochloride and platinum salt were examined. The body is the first member of a new series of organic bases in which both H's of the amine group are substituted by the bivalent aldehyde relic.

On Nitro-cuminole and its Derivatives, E. LIPPMANN and W. STRECKER (Ber. d. d. chem. Ges., vol. xii, p. 76).—*Nitro-cuminole,* $C_6H_3(NO_2)\begin{cases}CHO\\C_3H_7\end{cases}$, sulphur-yellow crystals, fusing at 54°. *Nitrocuminic acid,* $C_6H_3(NO_2)\begin{cases}COOH\\C_3H_7\end{cases}$. By oxidation of the preceding compound with potassium bichromate and sulphuric acid. Small bunches of crystals, fusing at 158°, or large crystals with lustrous faces. The silver and lead salts are amorphous precipitates. The acid is identical with the nitro-cuminic acid produced by nitrition of cuminic acid.

On the Compounds of Nickelous and Cobaltous Chlorides with Tar-bases, E. LIPPMANN and G. VORTMANN (Ber. d. d. chem. Ges., vol. xii, p. 79). — *Cobaltous chloride aniline*, $2C_6H_7N + CoCl_2 + 2C_2H_5(OH)$.—By treating 1 mol. of $CoCl_2$ in alcoholic solution with 2 mols. of aniline, a red salt separates in leafy crystals, having the above composition, but soon loses its alcoholic content, and turns blue. It does not combine with platinum chloride, but is decomposed, yielding $CoCl_2$ and $(C_6H_5NH_2HCl)_2\ PtCl_4$. Water also decomposes it into $CoCl_2$ and aniline.

Nickelous chloride aniline, $2C_6H_7N + NiCl_2 + 2C_2H_5(OH)$, apple-green precipitate, does not lose its alcohol under 100°, giving then a yellowish-green body, crystallizing in small needles.

Cobaltous chloride para-toluidine.—Glittering blue needles, free from alcohol. $2C_6H_7N + CoCl_2$. Ortho and metatoluidine gave no corresponding compound.

Nickelous chloride toluidine.—Green salt, contains alcohol.

Cobaltous chloride xylidine.—Bright blue small needles, free from alcohol.

Researches on the Bessemer Process, I. FRIEDERICH and C. G. MÜLLER (Ber. d. d. chem. Ges., vol. xii, p. 82).—Not suitable for abstraction.

On the Gases Enclosed in Iron and Steel, F. C. G. MÜLLER (Ber. d. d. chem. Ges., vol. xii, p. 93).—Contrary to the accepted idea that the gas consists of carbonous oxide, it was found that the chief constituent was hydrogen. Considerable nitrogen, and a small amount of carbonous oxide were also found.

	a.	*b.*	*c.*	*d.*
H.....	88.8	77.0	67.8	83.3
N.....	10.5	22.9	30.8	14.2
CO.....	0.7	—	2.2	2.5
AMOUNT OF GAS IN PER CENT. OF VOLUME OF METAL :	60%	45%	25%	35%

a. Bessemer steel. *b.* Ditto, after addition of spiegeleisen. *c.* Martin steel. *d.* Raw iron from cupola.

The pressure of the gas in the pores of the metal reached 8 atmospheres.

Further Communications on the Formation of Xanthine Bodies from Egg-albumine, H. KRAUSE and G. SALOMON (Ber.

d. d. chem. Ges., vol. xii, p. 95).—In the early stages of the putrefaction of blood fibrine, hypoxanthine is formed.

Oxidation-Products of Cinchonine, W. KÖNIG (Ber. d. d. chem. Ges., vol. xii, p. 97).—By oxidation with chromic and sulphuric acids, an acid was obtained which crystallized from hot water in beautiful glittering, silky needles. The copper salt was indigo blue, which, with the analysis of the acid, proved the latter to be identical with the cinchoninic acid of Weidel, $C_{20}H_{14}N_2O_4$, found by long boiling of cinchonine with conc., HNO_3. Heated with caustic lime, it gave chinoline. Hence, it would seem as if Weidel's formula should be halved, giving $C_{10}H_7NO_2 = C_9H_6N.COOH$, *chinoline-mono-carboxylic acid.* Heated with potassium hydrate, it gave an *oxy-cinchoninic acid*, $C_{20}H_{14}N_2O_6$, (*oxychinoline-mono-carboxylic acid*, $C_{10}H_7NO_3$), in white needles. Phosphorus pentachloride gave $C_{10}H_6ClNO_2$ (in short needles), thus proving the presence of an hydroxyl-group. The easy substitutability of the OH-group, makes it appear as if the oxycinchoninic acid were more nearly related to the fatty, than to the aromatic oxy acids, which are constituted analogously to salicylic acid.

Constitution and Syntheses of Carbo-triphenyl-triamine, W. WEITH (Ber. d. d. chem. Ges., vol. xii, p. 101).—By the action of phosphorus trichloride on a mixture of paranitrobenzoic acid and aniline, according to the formula, $3C_6H_4NO_2COOH + 6C_6H_5NH_2 + 2PCl_3 = 2PH_3O_3 + 3C_6H_4NO_2.C(NC_6H_5)(NH.C_6H_5) + 6HCl$, a *para-nitro diphenyl-amidine* was formed, which by reduction, gave carbo-triphenyl-triamine, identical with the body obtained by Hoffmann, as a side-product in the production of rosaniline by the action of tetrachlor-anethane on aniline, and by Basset from chlor-pikrin on aniline. Its constitution is hence:

$$C \begin{cases} C_6H_4.NH_2 \\ NC_6H_5 \\ NH.C_6H_5 \end{cases}$$

By action of HCl under pressure, it splits into para-amidobenzoic acid and aniline.

$$C_6H_4NH_2C(NC_6H_5)(NHC_6H_5) + 2H_2O = C_6H_4(NH_2)COOH + 2C_6H_5NH_2.$$

On the Formation of Hydrocinnamic Acid by Pancreatic Digestion, E. SALKOWSKY and H. SALKOWSKY (Ber. d. d. chem. Ges., vol. xii, p. 107).—Dried and powdered muscle, which had previously

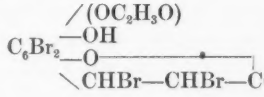
been extracted with water and alcohol, was mixed with the pancreatic glands of a dog, digested, boiled, and dialyzed. There was found to have been formed, besides butyric and valerianic acids, *hydrocinnamic* acid (*phenyl-propionic*), $C_6H_5CH_2CH_2COOH$. It was also obtained from fresh flesh.

On Daphnetine, CARL STUENKEL (Ber. d. d. chem. Ges., vol. xii, p. 109).—Pure daphnetine, obtained from the glucoside daphnine, which occurs in the bark of *Daphne alpine* and *Daphne mezereum*, fuses at 253–256°, with partial decomposition. *Mono-acetyle daphnetine* is formed by the action of acetyle chloride, or acetic anhydride on daphnetine. Long flexible, yellowish prisms, or small glittering needles, fusing at 129–130°. By boiling with magnesia and water, the acetyle group is split off.

Tetra-brom mono-acetyle daphnetine.—By action of bromine in very dilute alcoholic solution on the preceding compound. Fuses at 290°, and is difficultly soluble.

Monobenzoyle daphnetine.—By action of benzoyle chloride on daphnetine. Fine white needles in warty aggregations. Fuses at 149–150°. Insoluble in water and ether, difficultly in boiling alcohol, easily in chloroform and benzol.

Oxidizing and reducing agents gave no characterized compounds. Daphnetine is perhaps a di-oxycumarine, in which case the brom-acetyle derivative is



On the Ethers of Tribasic Formic Acid, ALFRED DEUTSCH (Ber. d. d. chem. Ges., vol. xii, p. 115).—*Ortho-formic-ethyl ether.* By action of 7 parts of sodium in 14 parts of ethyl alcohol, and 12 parts of chloroform. By use of these proportions, the formation of a resinous body which is encountered when the method of Wichelhaus and Ladenburg is followed, is avoided.

Ortho-formic-methyl ether.—Colorless, very mobile liquid, boiling at 101–102°, and possessing a pleasant odor. Easily inflammable. Sp. gr. at 23° = 0.974.

Ortho-formic-propyl ether.—The reaction with propylic alcohol is less violent. Boils at 196–198°. Burns with a rose-luminous flame. Sp. gr. = 0.879.

Ortho-formic-isobutyl ether.—Action weak. Boils at 220–222°. Sp. gr. = 0.861. Colorless liquid, not miscible with water. Burns with a luminous flame.

Ortho-formic-iso-amyl ether.—Colorless, oily liquid, not miscible with water. Sp. gr. = 0.864.

A benzyle ether could not be obtained.

Additions to the Law of Volumes, by H. SCHROEDER (Ber. d. d. chem. Ges., vol. xii, p. 119).—Not suitable for abstraction.

On Phospho-metals, OSCAR EMMERLING (Ber. d. d. chem. Ges., vol. xii, p. 152).—In order to avoid loss of phosphorus by the high temperature, the metal in the form of wire was placed in a glass tube with the phosphorus. The tube was heated until the phosphorous vapors had expelled the air, then closed and firmly imbedded in an iron tube with magnesia. The whole was heated to a dark red heat. The glass tube had to be opened in an atmosphere of carbonic acid, to avoid the inflammation of the phosphorus, which had not been entirely converted into the amorphous state.

Phosphorus and copper.—Brittle, fusible mass of a dull silver lustre. Heated in a tube, it lost part of its phosphorus. Insoluble in HCl, easily in HNO_3. Sp. gr. = 5.14. Composition is CuP, and it appears to be identical with Rose's copper phosphide, obtained by heating secondary copper phosphate in a stream of hydrogen.

Phosphorus and magnesium.—Lead-grey, unfused mass, extraordinarily unstable. Exposed to the air, it decomposed in a few minutes to a white powder of magnesium phosphate. In moist air it evolved hydrogen phosphide; with water the action was violent. Analysis could not be made.

Phosphorus and aluminum.—A compound could not be obtained. The metal remained unacted on. Mercury and iron also failed to give reactions.

Phosphorus and silver.—Black, very brittle mass, giving on heating, phosphorus and silver. Formula, AgP.

Phosphorus and cadmium.—The action succeeded only after repeated trials. The cadmium was used in the form of very fine wire. Sintered, grey mass, in some spots silver white, and enclosing brittle needles. Formula, Cd_2P.

Phosphorus and zinc.—Fused crystalline mass, giving off phosphorus at a high temperature, without fusing. Formula, Zn_3P_2.

Phosphorus and tin.—Tin-white body, having the composition SnP. With more phosphorus SnP_2 was obtained. Black, glittering

body, cleaving in very fine lamellae. Not acted on by HCl, but easily by aqua-regia. Sp. gr. 4.91 at 12°.

On the Behavior of Meta-nitro-anisole toward Ammonia, H. SALKOWSKY (Ber. d. d. chem. Ges., vol. xii, p. 155).—Meta-nitro-anisole, when heated with alcoholic ammonia, did not give a nitraniline, but remained unaffected. This reaction, hence, seems to fail with ortho-compounds, in the same manner as the conversion of nitro-amides into nitro-phenoles, by boiling with an alkali.

On the Behavior of Concentrated Potassium Iodide Solutions containing Lead, toward Hydrogen Sulphide, and on Potassium Iodide Crystals containing Lead, E. SCHERING (Ber. d. d. chem. Ges., vol. xii, p. 156).—As lead is sometimes contained in commercial iodine, it is occasionally met with in potassium iodide. In concentrated solutions of potassium iodide which contain lead, hydrogen sulphide produces at first a precipitate, but all the lead is not thrown down. In order to precipitate the whole of it, the solution must be very largely diluted. The presence of lead affects the crystalline form, as shown by diagrams.

On the Oxidation of Quinine by means of Potassium Permanganate, S. HOOGEWERFF and W. A. VAN DORP (Ber. d. d. chem. Ges., vol. xii, p. 158).—A full translation of this paper has been given on p. 80, No. 4, Vol. I, of this journal.

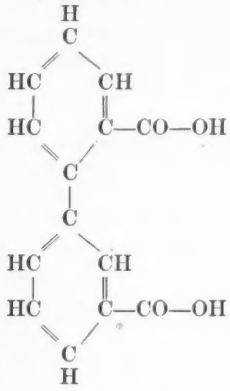
On the Structural Formulæ of Aromatic Compounds, E. WROBLEVSKY (Ber. d. d. chem. Ges., vol. xii, p. 161).—Instead of the terms ortho, meta and para, the author proposes the names of symmetrical, unsymmetrical and adjacent (benachbart), as being more convenient, viz:

Empirical.	Symmetrical.	Unsymmetrical.	Adjacent.
$C_6H_4Cl_2$.	$C_6H_2ClH_2Cl$.	C_6H_3ClHCl.	$C_6H_3Cl_2H$.

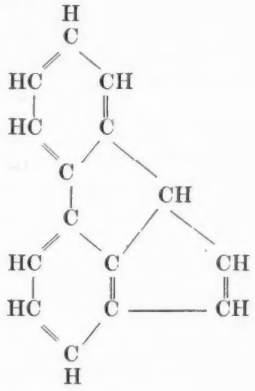
On the Constitution of Isodiphenic Acid and Fluoranthene, R. FITTIG and H. LIEPMANN (Ber. d. d. chem. Ges., vol. xii, p. 163).—By the action of fusing potassium hydrate on diphenyle-ketoncarboxylic acid, *isodiphenic acid* is formed.

$$\begin{array}{l} C_6H_4—CO \\ | \quad / \\ C_6H_3—COOH \end{array} + 2KOH = \begin{array}{l} C_6H_4—CO—OK \\ | \\ C_6H_4—CO—KO \end{array} + H_2O.$$

The acid, on heating with lime, gives diphenylene-ketone and carbonic acids, thus resembling diphenic acid. Hence, it follows that one of the carboxyle groups is ortho to the mutual point of attachment of the phenyle groups. On oxidation the acid yielded isophthalic acid. Hence the constitution is :



Isodiphenic Acid.



Fluoranthene.

On the Estimation at High Temperatures of the Vapor Densities of substances which Attack Mercury, L. PFANNDLER (Ber. d. d. chem. Ges., vol., xii, p. 165).—Not suitable for abstraction.

Action of Nitrosyle Chloride on Unsaturated Hydrocarbons, PAUL TÖNNIES (Ber. d. d. chem. Ges., vol. 12, p. 169).—Bodies, similar to the addition-compounds of nitrous anhydride with unsaturated hydrocarbons, were obtained. With amylene, a beautiful crystalline compound, $C_5H_{10}NOCl$, was formed. Anethole gave $C_6H_4\begin{cases}OCH_3\\C_3H_5NOCl\end{cases}$ On reduction of the amylene compound, amylamine was formed. The anethole derivative gave $C_6H_4\begin{cases}OCH_3\\C_3H_6NH_2\end{cases}$.

This, then, is a convenient method for the formation of primary amines.

Paris Academy of Science.

Meeting of Jan. 6th, 1879.

Abstractor, P. CASAMAJOR.

On the Formation of Organic Ultramarines, M. de FORGRAND.—Silver ultramarine is prepared by the process of Mr. Heumann.* By heating the silver ultramarine in the dry, with a chloride of a metal, the author obtained chloride of silver and an ultramarine of the metal. This process was published in the *Bulletin de la Société Chimique*, vol. xxx, p. 112. As this reaction is very general, he applied it to the production of organic ultramarines, by heating silver ultramarine with the chlorides and iodides of the various alcoholic radicals.

The silver ultramarine is placed in a closed vessel and heated to 180° C., with an excess of ethylic iodide. After heating 15 to 18 hours, the product is washed with sodic hyposulphite and water, and heated again in the closed vessel in presence of an excess of ethylic iodide. This operation is repeated until the product, after being washed, contains no more silver, this metal having been removed in the state of iodide.

The result is a light grey powder which, on being heated, gives ethylic sulphide. If the powder is mixed with pulverized sodic chloride and the mixture is heated, ethylic sulphide is not given off, and the powder turns from grey to blue, reproducing ordinary ultramarine with all its characteristics.

To ascertain the presence of ethyl in this substance, the author collected the substances resulting from its decomposition by heat in mercuric chloride. The crystalline precipitate, on being analyzed, shows, that the substance obtained was a true ethylic ultramarine.

Analogous reactions were obtained with the iodides of other alcoholic radicals, also with a certain number of iodides of ammonium quarternaries. These results will be given in future communications.

Researches on Ozone and Electricity, M. BERTHELOT.—The most important experiment of the author is the following: "The decomposition of pure carbonic acid by electricity, in a space free from mercury and from oxidizable substances, gives rise to interesting phenomena which lead us to suspect the existence of per-carbonic acid. After passing electricity for 12 hours in the annular space

* Deutsche chemische Gesellschaft, vol. x, p. 991.

between concentric tubes closed by melting over the lamp, I found 16 cubic centimeters of decomposed carbonic acid. This gas attacked mercury and oxidizable bodies with extreme violence. If the oxidizing portion of this gas is ozone, the quantity of this substance was 30 p. c. of the liberated oxygen in one case, and, in another case, 41 p. c. These quantities are enormous compared to those obtained with pure oxygen.

"It would be very interesting to isolate the oxidizing substance formed in this reaction, but when we have tried to separate the carbonic acid and carbonic oxide of the preceding mixture, the oxidizing gas is destroyed by the reagents used for this separation. This gas might be considered as oxygen strongly charged with ozone or with per-carbonic acid, C_2O_6, but I have not been able to discover any properties by which to distinguish this last compound from ozone mixed with carbonic acid."

On the Formation of Ethers of Hydracids in the Gaseous State, M. BERTHELOT.

Researches on the Compressibility of Gases, M. L. CAILLETET.—A description of his new apparatus, and the results obtained with nitrogen.

M. MONOT presented to the Academy specimens of ***Results Recently Obtained in the Manufacture of various kinds of Crystal Glass.***

"Aventurine is obtained by reducing copper by iron.

"To obtain an imitation of the glass called *vermeil*, a glass of any kind is covered with a thin layer of glass charged with copper. The metallic surface is then obtained by a reducing gas.

"The metallic crackled glass is obtained by using a crystal glass charged with oxide of silver. This is covered with some other glass of any color. By taking off this glass in places, the silver glass is laid bare, and metallic effects are obtained by a reducing flame."

New Compound Prism. for Direct Vision Spectroscopes of great Dispersive Power, M. THOLLON.

Note on the Spectroscope of M. Thollon, M. LAURENT.

Syntheses of Uric Derivates of the Alloxan Series, M. E. GRIMAUX.

On the Action of Diastase, of Saliva and of Pancreatic Juice on Starch and Glycogen, Note by Messrs. F. MUSCULUS and I. VON MERING.—Conclusions: The following are the results of our experiments:

1st. Saliva and the pancreatic juice give, with starch, the same products as diastase, maltose and glucose.

2d. Glycogen gives with saliva and diastase, reducing dextrines, maltose and glucose, the same as starch.

3d. The dextrines of glycogen differ from those of starch in being less hygroscopic, and in having a less reducing power. Moreover, there is produced, in the saccharification of glycogen, a dextrine which is not acted on by diastase and saliva when the reducing power reaches 37. This only happens with starch when the reducing power is 50. Diastase acts with less energy on glycogen than saliva.

4th. There exists only one glycogen, whether the animal from which it is obtained has been fed exclusively on carbo-hydrates or on albuminoid substances.

5th. The existence of reducing dextrines with variable rotatory powers which accompany maltose and glucose, shows the necessity of using fermentation for the determination of sugar in physiological examinations, and explains the difference of results obtained by experimenters using the fermentation method, and such using Fehling's method.

On the Employment of Powdered Borax for the Preservation of Meat, by M. G. LE BON.

At the *Meeting of January 20th*, 1879, M. PASTEUR answers to the remarks made by M. Berthelot, at the meeting of Jan. 13th, and to a note of M. Tréuil, read at the same meeting. In this answer to M. Tréuil, occurs the following:

"M. Tréuil says: 'In his second note, M. Pasteur states (p. 1040, *Comptes Rendus*, vol. lxxxvi) that the vibrio of septicaemia resolves itself into germ corpuscles which exist in air, and are preserved in it.' I never wrote this; I never said that the germ corpuscles of the vibrio of septicaemia can live in air; it is the very reverse that is written and proved on this page 1040.

"It is demonstrated in this communication, particularly at p. 1040, that the vibrio of septicaemia *cannot live in air;* that air kills and destroys it."

On Citric Acid and its Homologues, Note of M. EUG. DEMARCAY.

Report on Foreign and American Patents relating to Chemistry.

Foreign Patents.

Condensed from R. BIEDERMANN's Report to the German Chemical Society, by H. ENDEMANN.

JAMES MACTEAR, Glasgow : *Utilization of by-products in the manufacture of soda.* (Engl. P., No. 815, Feb. 28, 1878.)—Treats on the preparation of calcium bisulphite.

JOHN HOLLWAY, London : *Sulphur from pyrites.* (Engl. P., No. 500, Feb. 6, 1878.)—The pyrites are brought to a red heat and then decomposed by the action of superheated steam. Sulphur and hydrogen sulphide are formed. In the case of copper pyrites the residue consists of CuS and Fe_2O_3. Arsen tersulphide is removed from the distilled sulphur by means of soda or sodium sulphide.

A. CLEMM, Mannheim : *Preparation of potassium and sodium phosphate from potassium or sodium sulphate and phosphoric acid.* (Germ. P., No. 3588, July 9, 1878.)—The sulphates are reduced by heating with charcoal, then partially oxidized by a current of air when moistened with water, and perhaps also by allowing sulphurous acid to act upon the solution until only hyposulphites are present, which are decomposed by phosphoric acid.

PETER STUART BROWN, Carrickfergus, Ireland : *Preparation of ammonium sulphate.* (Engl. P., No. 804, Feb. 27, 1878.—To allow of the use of iron vessels, the gas-water is but partially saturated, and during evaporation always kept alkaline. Ammonium sulphate is obtained as first crystallization. Cyanide and sulpho-cyanide from the mother liquors.

JOHN BARROW, Clayton, near Manchester. *Manufacture of ammonium salts and utilization of by-products.* (Engl. P., No. 891, March 5, 1878.)—Gas-water is distilled with calcium sulphide from the purification of illuminating gas or other sources, and the distillate is brought into sulphuric or muriatic acids. The sulphuretted hydrogen is then utilized by converting it into sulphur or sulphurous acid. Bisulphide of carbon is obtained by using an oil-scrubber.

JOHN ALFRED STEPHAN, Worcester : *Manufacture of illuminating gas.* (Germ. P., No. 3856, March 19, 1878.)—Peculiar apparatus for the manufacture of carburetted water-gas.

MYRON HOPKINS STRONG, Brooklyn : *Apparatus for the preparation of water-gas, and carburetting the same.* (Germ. P., No. 3174, Dec. 18, 1877.)

PAUL PAVLOWITSCH TIMOFEEFF, St. Petersburg : *Method and apparatus for the manufacture of illuminating gas.* (Engl. P., No. 2350, June 13, 1878 ; Germ. P., No. 3987, June 7, 1878.)—Hydrogen, prepared by zinc and sulphuric acid, is carburetted by a layer of petroleum ether covering the acid.

HENRY BAGGELEY, London : *Treatment of sewerage and preparation of a manure therefrom.* (Engl. P., No. 511, Feb. 7, 1878.)

ROBERT PUNCHON, Brighton : *Treatment of sewerage.* (Engl. P., No. 581, Feb. 12, 1878.)

WILL. VIRGO WILSON, London: *Cyanides from the waste products of illuminating gas manufacture.* (Engl. P., No. 314, Jan. 24, 1878.)—The invention claims the use of petroleum or benzol, for the removal of tar from the products.

AUGUST LEONHARDT, Mainkur: *Regeneration of arsenic from the waste products of the manufacture of fuchsin.* (Germ. P., No. 3216, Dec. 25, 1877; Engl. P., No. 519, Feb. 8, 1878.)—The solutions containing the arsenic are evaporated and then burned. The volatilized arsenic is collected in the usual manner.

ADOLPHE GEORGE, Marseilles: *Improvement, manufacture of soap.* (Engl. P., No. 833, March 1, 1878.)—Relates merely to the heating of the tanks by steam.

JOHN BRUET MACKEY and JOHN SELLERS, London: (Engl. P., No. 934, March 7, 1878.)—Add 7 pts. of potassium bichromate to 112 pts. of soap, believing that such soap in use will furnish free oxygen which will assist in cleaning.

CH. BANKS COOPER and CHRIST. WEBB SMITH: (Engl. P., No. 945, March 8, 1878.)—Add to soap a solution of camphor, in alcohol or oil of turpentine, or pulverized carbonate of ammonia and borax. Soft soap is improved by the addition of tar dissolved in wood spirits.

E. DELARUE & CO., Paris: (Eng. P., No. 647, Feb. 15, 1878.),—*Saccharification of starch* by means of organic acids, by preference, tartaric and oxalic acids. Of the latter only 3-1000 of the weight of the starch is required; temperature 140° C. The reaction takes place under pressure, and is completed in 45 minutes.

E. SCHERING, Berlin (Germ. P., No. 2660, April 7, 1878), prepares *celloidine*, which is merely a collodium evaporated to the consistency of a thick glue, and cast into moulds.

E. SCHERING, Berlin: (Engl. P., No. 4771, Dec. 27, 1877.)—*Preparation of pure nitrocellulose for collodium.* The ordinarily treated nitrocellulose is washed with a solution of sulphurous acid, to remove certain acid compounds.

CLARK JOHNSTON, Rochester, N.Y.: *Lubricator.* (Engl. P. No. 875, Feb. 20, 1878.)—Gives a number of prescriptions, all containing graphite.

COLL. TAYLOR, Algiers: (Engl. P., No. 959, March 9, 1878.)—Uses the decoction of an Algerian plant for extinguishing fires.

FR. REICHENKORN, Charlottenburg: *Method and apparatus for the preservation of yeast.* (Germ. P., No. 3873, Jan. 22, 1878.)—The yeast is brought by means of certain machinery into the shape of thin threads, which may readily be dried at a temperature below the temperature for the coagulation of albumen.

WM. J. BLINCKHORN, St. Helens: *Improvements in the manufacture of sulphuric acid.* (Engl. P., No. 1084, March 19, 1878.)

FRANÇ. LAUR, Paris: *Improvement in the manufacture of aluminium sulphate.* (Engl. P., No. 771, Feb. 25, 1878.)—The patent relates to the preparation of aluminium sulphate from bauxite.

WILH. GOEBEL, Hanover: *Purification of illuminating gas.* (Germ. P., No. 4346, May 26, 1878.)—Mixes the illuminating gas with ammonia, cools in the condensers and scrubs with gypsum water. He thus removes carbon dioxide, hydrogen sulphide, cyanogen, carbon disulphide, carbon oxysulphide.

PAUL HUTH, Woermlitz: *Lubricator which will withstand high temperatures.* (Germ. P., No. 4219, May 19, 1878.)—10 to 19 per cent. of aluminium oleate are dissolved in a hydrocarbon of high boiling point.

W. KELBE, Carlsruhe: *Purification of oils containing rosins.* (Engl. P., No. 886, March 5, 1878.)—50 kgs. of the oil are heated with 8 l. of a solution of soda, 1.215 spec. gr., and the rosin soap thus obtained is removed by the addition of water.

CHARLES NEALE MAY, Devizes: *Extraction of fat.* (Engl. P., No. 1186, March 26, 1878.)—Apparatus for the extraction of fat by means of bisulphide of carbon, benzol, petroleum and amylic alcohol.

A. MITSCHERLICH, Munich: (Germ. P., No. 4178 and 4179, Jan. 23, 1878.) —Treatment of wood for the production of tannic acid, cellulose, gum, acetic acid and bisulphite of lime. Wood is heated with a solution of bisulphite of lime, in closed vessels, to a temperature of 180° C., for 8 hours. Free sulphurous acid, which is formed, is then again used for the production of bisulphite of lime in a peculiar apparatus. The liquor is drawn off the wood, and may then be at once used for tanning, or the tannic acid may be precipitated by lime, and the residual liquor be evaporated. Thus the gum and acetic acid may be secured, as also alcohol, when the residue is fermented. The wood fibre is very white, and may at once be used for the manufacture of paper.

FREDERICK MANN, Koroit Creek, Australia: (Germ. P., No. 4220, May 28, 1878.)—*Improvement in the manufacture of nitroglycerine,* by cooling the acid and nitroglycerine mixture until the nitroglycerine becomes solid, and then removing the acid by means of a centrifugal machine.

ACTIEN-GESELLSCHAFT FUER ANILINFABRIKATION, Berlin: *Manufacture of artificial colors by the action of benzotrichloride upon aromatic tertiary amines and phenols.* (Germ. P., No. 4322, Feb. 26, 1878.)—While dimethylaniline and aromatic tertiary monamines furnish green colors, phenols and benzotrichloride yield yellow, red and brown products; resorcin produces a substance which is very similar to fluorescëin.

FR. GRAESELER, Cannstadt: *Method for the preparation of amidoazobenzolsulfonic acid.* (Germ. P., No. 4186, May 12, 1878.)—The inventor calls amidoazobenzol a compound of the formula $C_{12}H_9(NH_2)N_2$, which is formed by the action of the nitrous acid on aniline. The sulfonic acid is obtained by treatment of this substance with Nordhausen oil of vitriol at ordinary temperatures, or 70° to 100°.

DANIEL FENTON, Manchester: *Method of rendering paper and similar substances waterproof,* by the use of zinc or cadmium chlorides or sulphates and ammonia water. (Germ. P., No. 3467, July 16, 1877.)

JULES CROUZIERES, Marseilles (Engl. P., No. 1120, March 21, 1878), makes *pasteboard waterproof,* by a solution of gutta percha in tar or linseed oil, to which have been added zinc white, ochre and caoutchouc.

THOMAS MEIFFREN, Marseilles: *Alloys of metals.* (Engl. P., No. 1075, March 18, 1878.)—The patent gives descriptions of the composition of one alloy similar to gold (copper, platinum, tungsten and gold), and another similar to silver (iron, tungsten, nickel, aluminium and copper).

F. KÖPPEN, Stassfurt: *Concentration of salt solutions.* (Germ. P., No. 3997, July 17, 1878.)—The concentration is produced by the waste heat from the boilers.

JOSEF BERSCH, Baden, near Vienna: *Bung for beer barrels with automatic valve to regulate the pressure.* (Germ. P., No. 3826, July 3, 1878.)

LUIGI PERONI, London: *Improvement in the manufacture of glass tubing for thermometers.* (Engl. P., No. 317.)

American Patents.

Condensed from the Official Gazette of the **U. S. Patent Office**, by ARNO BEHR.

April 1, 1879.

213,733.—*Treatment of albumen for the production of molded articles.* JONATHAN BLISS.

Brief: Pure albumen is dried and pulverized, after which the powder is formed into various articles in heated moulds under pressure.

A factory for the manufacture of buttons is in successful operation in Jersey City.

213,815.—*Apparatus for making infusions.* R. U. ETZENSBERGER.

213,824–826.—*Preserving meats in the raw state.* ARTHUR A. LIBBY.

Several modifications of a process, the leading idea of which seems to be to catch and destroy all germs of putrefaction, in a coating of an antiseptic and adhesive mixture, which is spread on the surface of the meat and the inner surface of the cans. To prevent the lesion of this protecting coat, the meat is kept from contact with the walls of the can. Before the sealing of the cans, the air in them is replaced by such which has been heated to the destruction of all germs of putrefaction.

213,907.—*Processes of dyeing aniline black.* H. KINSBOURG.

The claim is for dyeing vegetable fibrous material at a low temperature in a bath composed of about 20 lbs. of bichromate of potassium, 30 lbs. sulphuric acid, 20 lbs. chlorhydrate of aniline and 400 to 600 gallons of water.

April 8, 1879.

214,042.—*Processes and apparatus for the manufacture of coal gas.* CHAS. W. ISBELL.

The process consists in utilizing the volatile bodies contained in the tar, for the production of gas, by passing their vapors together with steam and gas through a separate set of heated retorts.

214,055.—*Extracting precious metals from ores.* T. A. ROBERTSON.

Heating the ore to a red heat and afterwards plunging it in a solution of salt, sulphate of copper and cyanide of potassium.

214,142.—*Processes for making artificial marble.* HARRIET G. HOSMER.

Proposes to give to limestone or alabaster the appearance and uniform hardness of natural marble, by impregnation with a solution of alum in water and the application of moist heat.

214,210.—*Making sheet castings without blow holes.* F. VALTON, T. EUVERTE and A. POURCEL.

The process consists in "providing the initial bath with manganese, then putting in the scrap or other metal, and finally adding to the charge silicon, manganese and iron, the iron containing carbon."

214,222.—*Separating animal and vegetable fibres in mixed fabrics.* T. WILKINS.

Improvement on patents Nos. 203,230 and 203,231, consisting in the treatment with sulphate of alumina and subsequent heating, by which the vegetable fibres are disintegrated.

April 15, 1879.

214,344.—*Separating metals by electrolysis.* E. ANDRE.

The process is to be applied to alloys which, besides a base metal, contain a small amount of precious metals. In a series of cells, filled with a convenient salt of the base metal, the alloy in a proper shape is used as an anode. The base metal only is dissolved under the influence of the electric current and deposited on the cathode. The undissolved precious metals of the anode are prevented from being carried away and being again mixed with the base metal, by a porous diaphragm.

214,348.—*Manufacture of artificial marble and stone.* WM. C. BAKER, Jun.

240,360.—*Compositions for cleansing the surfaces of metals.* A. B. BROWN.

To prepare wire for coating with another metal, it is coated first with a solution of an alkaline phosphate and then with a solution of a caustic alkali.

214,391.—*Treating and curing tobacco.* CH. HORNBOSTEI.

Proposes to subject tobacco to the action of oxygen or "oxygenated air."

214,412.—*Purifying and increasing the illuminating power of gas.* O. LUGO.

Animal charcoal is used as a purifying agent. The absorbing and decomposing action of the black on the impurities of the gas, is most complete, if the latter is mixed with a certain proportion of air before its passage over the black. The black itself is impregnated with a volatile hydrocarbon, and in this way any decrease in the illuminating power of the gas is avoided.

April 22, 1879.

214,559.—*Processes for extracting saccharine matter from vegetable substances.* E. T. GENNERT.

The invention relates to the treatment of dried beets by the diffusion process. In order to prevent lactic fermentation and the swelling

of the chips, by which the free passage of the water would be prevented, the chips are moistened with a solution of superphosphate of lime, before extraction begins.

214,594.—*Lubricants.* WM. SMITH.

Palm oil, 4½; cotton-seed oil, 10; lard oil, 10; crude petroleum, 25 parts.

214,636.—*Electric lights.* T. A. EDISON.

Brief: The heat of the lamp operates an automatic device for the purpose of relieving the intensity of the current through the incandescent light-giving strip, by throwing a portion of the current, when the light becomes too intense, through another circuit.

May 6, 1879.

215,096.—*Refining copper.* MARIA CHAPMAN.

Treating molten copper with "an argillaceous mineral, an alkali, borate of soda, carbon or carbonaceous matter and glass."

215,108.—*Filter presses.* A. DREVERMANN.

The filter presses described in this patent have excited a great deal of interest among chemists and manufacturers in Germany. Essential features are the absence of any kind of filtering cloths, plates of prepared coke or sandstone being used as a filtering material. The presses can be worked under very high pressure and allow a perfect washing of the residue. The arrangement is rather complicated, and cannot be properly described without reference to drawings.

215,199.—*Explosive compounds.* A. DIECKERHOFF.

Mixtures in different proportions of alkaline pikrates, nitrates and sulphur, with or without charcoal.

May 13, 1879.

215,287.—*Process for obtaining pure yeast and producing specific fermentation.* J. C. PENNINGTON.

The process consists in taking care that a small quantity of good yeast or another organized ferment, which is to be used as seed, is perfectly pure and uniform and free of other ferments. This is done by enclosing the material in a flattened capillary glass tube and examining it with the microscope. A special claim relates to these flat capillary tubes.

May 20, 1879.

215,463.—*Solutions for electrolysis of lead.* N. S. KEITH.

An improvement on a previous patent for the production of pure lead from base bullion, by means of electrolysis, consisting in the addition to the solution of lead, in which electrolysis takes place, of a salt, the solution of which is a better conductor of electricity than lead salts.

215,471.—*Process for freezing and pressing paraffine oil.* T. M. McMillan.

Crude paraffine oil from petroleum is cooled down to about 0° F., and the liquid part separated while cold by filtering under pressure.

215,477.—*Assayers self-calculating sample and button weighers.* T. S. Phillips.

215,572.—*Purifying, circulating and rarifying air.* A. T. Chase.

Air, before being admitted into the room, is conducted over ice, then heated and finally passed "over disinfecting chemical substances."

May 27, 1879.

215,756.—*Process and apparatus for distilling petroleum.*—J. L. Kirk.

The crude petroleum enters in a continuous flow a series of parallel pipes connected at their alternate ends, and placed in a furnace. The vapors evolved in the separate sections of the pipe pass through filters, and after being mixed with sulphuric acid vapors are separately condensed.

215,757.—*Composition for casting ornamental figures.* A. Kiesele.

The composition consists of a mixture of paraffine and starch.

215,811.—*Process and apparatus for mashing grain.* T. A. Eberhardt.

In order to prevent the formation of acids in the mash, the malt is mixed with the boiled grain in vacuo.

215,875.—*Lubricating materials for use in wire drawing.* A. B. Brown.

A mixture of a solution of alkaline phosphate and flour.

215,899.—*Solutions for galvanic batteries.* Chas. A. Ehrenberg.

Claim: The use of urine as an excitant in galvanic batteries

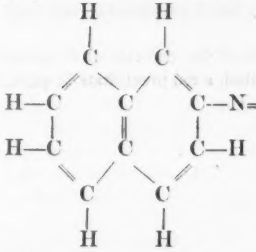
MISCELLANEOUS.

At the conversazione of May 15th, held at the Stevens Institute of Technology, Hoboken, N. J., President Henry Morton and Mr. Wm. E. Geyer exhibited a number of specimens and some experiments illustrating the formation of the new dyestuff now beginning to attract much attention, and known by the trade names of "fast-red" and "rocceline," and which is, in fact, a compound from diazo-naphthaline and β naphthol, together with sulphuric acid, and by preference, also, with an alkaline base; in other words, a sodium salt of the sulpho-acid of oxyazonaphthaline.

The process of building up this compound, beginning with naphthaline, is as follows:

Naphthaline, by treatment with nitric acid, is converted into nitro-naphthaline. This, by distillation with acetic acid and iron, is converted into naphthylamine, and this, by addition of hydrochloric acid, into hydrochlorate of naphthylamine. If a solution of this salt, acidulated with hydrochloric acid, is poured into a solution of sodium nitrite, the naphthylamine will be converted into diazo-naphthaline, by the introduction of an atom of nitrogen in place of the two hydrogen atoms of the amine root.

This body will remain combined with chlorine as a chloride of diazo-naphthaline. Its graphical formula would then be as follows :



or

$C_{10}H_7—N=N—Cl.$

This body and others like it, in reference to its diazo branch, have a remarkable facility in uniting with many phenoles and amines, thus forming highly colored compounds, which alone or as sulpho-acids, have the property of staining animal tissues, such as wool, silk, &c., without any mordant.

In the particular case before us, this diazo-naphthaline is caused to unite with that variety of naphthol known as β naphthol.

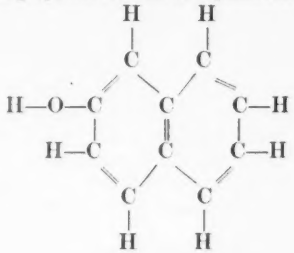
This is prepared as follows :

Naphthaline is heated with oil of vitriol to a temperature of 180° C., and is thereby converted into a sulpho-acid of naphthaline, which may be distinguished as the β variety. On dilution with water, the unchanged naphthaline precipitates, and the clear liquid is then treated with lime, to remove excess of acid. By this treatment the sulpho-naphthylic acid is converted into a lime salt ; this lime salt is freed from the sulphate of lime, and by treatment with carbonate of soda is converted into a soda salt, which, being freed from the carbonate of lime, is concentrated and crystallized.

This sodium salt of β sulpho-naphthylic acid is then fused with caustic soda, by which a compound of β naphthol and soda is formed, and this, by addition of any strong acid, yields β naphthol, which deposits as a powder, gradually acquiring a crystalline character. It may be purified by crystallization from solution in hot water, and when dried on a filter acquires a silvery lustre of unusual beauty.

If exactly the same treatment is pursued, except that the naphthaline is heated with oil of vitriol, only to 100° C., we obtain at the end a very different naphthol, known as α naphthol, which crystallizes in long needles instead of plates, and throughout its stages of formation is remarkable for forming much more soluble compounds than the β variety.

The graphical formula of naphthol, so far as we know, may be given as follows :



$C_{10}H_7—O—H.$

Little or nothing, however, is known about the position of the hydroxyl molecule; and, at all events, we have as yet no idea as to what constitutes the difference between the α and β varieties, which presumably can only differ in this respect.

By simply pouring together solutions of the chloride of diazo-naphthaline, shown in the first formula, and of β naphthol, a red precipitate is quickly formed which consists of oxyazonaphthaline; and when this is treated with strong fuming sulphuric acid, the sulpho-acid compound results, which constitutes the beautiful red dye-stuff named "fast red" or "roccelline," as we mentioned at first.

If, however, at the corresponding stage of the operation, we add a solution of α naphthol in place of the β naphthol, the solution acquires an orange in place of a red color, and on further treatment only yields a brown dye.

In place of introducing the sulpho-acid at the end of the operation, as above, it may be introduced either into the naphthylamine, forming naphthionic acid, or into the naphthol. In these two cases it is, of course, to be presumed that in the final compound the sulpho-acid will be in different parts of the molecule in each case. Where the sulpho-acid is introduced after the formation of the oxyazo compound—we as yet have no idea as to where it is attached.

The formation of the oxyazo compounds in these several ways was exhibited to the members present, the lecture table being illuminated by the electric light to show the various color changes.

President Morton then alluded to the statement in Maumene's recent work, that sugar inverted by boiling alone, or with acid, had a greater specific sweetness than cane sugar, and stated that as a result of a number of experiments made under his direction by Mr. Henry Beckmayer, in which the opinions of many persons unacquainted with the experiments and ignorant of the composition of the various solutions, had been collected, he found Maumene's statement to be confirmed in so far that the inverted sugar was weight for weight, somewhat sweeter than cane sugar, and that including the gain in weight by inversion, a given weight of cane sugar would certainly acquire at least ten per cent. more sweetening power by inversion. Solutions for comparison were presented to the members present.

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